OWON

HDS1022M

Handheld Digital Storage

Oscilloscope & Multimeter

User's Manual

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1.Declaration of Conformity

1.1 Declaration of Conformity

HDS1022M Handheld Digital Storage Oscilloscope & Multimeter

Manufacturer: Fujian Lilliput Optoelectronic Technology Co., Ltd

Statement of Conformity
Base on the result using appropriate standards,the product is in conformity with
Electromagnetic Compatibility Directive 89/336/EEC
Low Voltage Directive 73/23/EEC

Sample tests
Standards used:
EN61010.1：2001（2nd edition）
Safety Requirements for Electrical Equipment for Measurement, Control, and Laboratory use-part 1:General Requirements

EN61326：1997+A1：1998+A2：2001+A3：2003
Electrical Equipment for Measurement, Control and Laboratory use-EMC Requirements-part 1. General Requirements

EN61000-3-2：2000+A2：2005
Electromagnetic Compatibility(EMC)-part 3:Limits-Section 2:Limits for Harmonic Current Emissions (Equipment Input Current less than/equal to 16A per phase)

EN61000-3-3：1995+A1：2001
Electromagnetic Compatibility (EMC)-part 3:Limits-Section 3 Limitation of Voltage Fluctuations and Flicker in Low-Voltage Supply systems for Equipment with Rated Current less than or equal to 16A

The tests have been performed in typical configuration.
This conformity is indicated by the symbol CE, i.e."Conformite Europeenne".

1.2 Open the Oscilloscope Parts Box,You Can See the Parts Below (see the picture below)

#	Description	Standard	Optional
1	HDS1022M and Battery	●	
2	Battery Charger	●	
3	Oscilloscope Probe x 2 (grey)	●	
4	Multimeter test lead x 2 (black and red)	●	
5	Extension module for big capacitance measurement	●	
6	Module for small capacitance measurement	●	
7	Probe adjustment tools	●	
8	USB communication cable or RS-232C communication cable	●	
9	User Manual	●	
10	CD-ROM (software)	●	
11	Hard carrying case		●
12	Soft carrying case		●
13	5v output cable with a frequency of 1 kHz as the test-signal	●	

figure 1: Digital Oscilloscope Parts

2.Safety Information

In order to ensure the correct using and the best efficient service, please carefully read this user's manual.

2.1 Safety Terms and Symbols

2.1.1 Specific Warning and Caution Terms that Appear throughout the Manual

Warning: "Warning" identifies conditions and actions that pose hazards to the users.

Caution: "Caution" identifies conditions and actions that may damage the product or other properties.

2.1.2 Terms Used on the Product

The following terms appears possibly on the product:

Danger: The term "Danger" is used in this manual to indicate that when you read this mark, personal injury may be caused to you immediately.

Warning: The term "Warning" is used in this manual to indicate that when you read this mark, personal injury may not be caused to you immediately, but you need to be cautionary.

Notice: The term "Notice" is used in this manual to indicate that damages may be caused on this product or other properties.

2.1.3 Symbols Used on the Product.

The following symbols appear possibly on the product.

High Voltage

Please Consult the Manual.

Protective Ground End

Earth End on the Shell

Grounding End for Measurement

2.2 General Safety Information

Carefully read the following safety information in order to avoid any personal injury and damage on this product or any products connected with it. This product can only be used in the specified applications to prevent any possible dangers.

⚠ Warning:

To avoid fire or electrical shock. Please use proper power adapter. Use only the power adapter appointed by the manufacturer and subject to approval of being used in the user's country.

⚠ Warning:

To avoid fire or electrical shock if a test tool input is connected to more 42V peak (30Vrms) or on circuits of more than 4800VA:

- **Use only insulated voltage probes, test leads and adapter supplied with the test tool, or indicated by OWON as suitable for the Oscilloscope & Multimeter.**
- **Before use, inspect voltage probes, test leads and accessories for mechanical damage and replace when damaged.**
- **Remove all probes, test leads and accessories that are not in use.**
- **Always connect the power adapter first to the AC outlet before connecting it to the Oscilloscope & Multimeter.**
- **Do not apply voltages that differ more than 400 V from earth ground to any input when measuring in a CAT Ⅱ environment.**
- **Do not apply voltages that differ more than 400 V from each other to the isolated inputs when measuring in a CAT Ⅱ environment.**
- **Do not apply input voltages above the rating of the instrument Use caution when using 1:1 test leads because the probe tip voltage will be directly transmitted to the Oscilloscope & Multimeter.**
- **Do not use exposed metal BNC or banana plug connectors.**
- **Do not insert metal objects into connectors.**
- **Always use the Oscilloscope & Multimeter only in the manner specified.**

- **Voltage ratings that are mentioned in the warning, are giver as limits for "working voltage". The represent V ac rms (50-60Hz) for AC sine wave applications and as V dc for DC applications. Overvoltage Category Ⅱ refers to local level , CAT is the prefix refers to level II, Class II is a low-voltage high-energy level, which is applicable for appliances and portable equipment .**

Only qualified technical personnel are permitted to perform maintenance.

Pay attention to the nominal values of all terminals: To avoid fire or electric shock, please keep a watchful eye on all nominal values and marks specified for this product. Before any connection performed on this product, carefully read the user's manual of the product for further information of nominal values.

No operation is allowed without the instrument cover plate: If the cover plate or panel has been removed, do not perform any operation on this product.

No touch is allowed on bare conductors: When the product is powered on, do not touch any bare joints or parts of the scope meter.

Operation is prohibited in case of any undetermined failure: When in doubt any damage on this product, consult the qualified personnel for checking on it.

Keep ventilation in good condition: Refer to the user manual for detail installation instructions in order to fix this product correctly and provide it with good ventilation conditions.

No operation is allowed under a humid environment.

No operation is allowed under an explosive environment.

Keep clean and dry on the product surface.

The method which stipulated according to the factory does not use the equipment, possibly can damage the protection which the equipment provides.

3. Performing the General Inspection

3.1 Performing the General Inspection

When you have got a new HDS series oscilloscope, it is suggested that you should perform a general inspection on the instrument according to the following steps.

3.3.1 Check whether there is any Damage on it Due to Transportation

If the packing boxes or foam cushions are found in serous damage, keep them in a proper place till the complete instrument and accessories have passed the electrical and mechanical tests.

3.3.2 Make a Check on Accessories

The accessory list has been described in the picture of Digital Oscilloscope Parts of this manual. You can make a check and find whether there is any accessory loss with reference to the Appendix. In case of any accessory loss or damage, consult the OWON dealer responsible for such a business or the local office of OWON.

3.3.3 Make a Check on the Complete Instrument

If the instrument is damaged in its appearance or it fails in normal operation or performance test, consult the OWON dealer responsible for such a business or the local office of OWON. If the instrument is damaged due to transportation, keep the packing in a proper place and consult the transportation department and the OWON dealer responsible for such business, who will provide an instrument replacement or maintenance.

4.Input Connections

4.1 Input Connections

See the following figure 2:

figure 2

Description:

1. The power adapter is supplied for AC power supply and battery recharging.
2. Multimeter test lead.
3. Multimeter input jacks, including three circular banana jacks and tow square jacks. The three circular jacks are used for voltage, current and resistance inputs, while the two square jacks are used for capacitance inputs.

4. Oscilloscope probes.
5. Oscilloscope channel inputs: the upper one is for Channel 1 (CHI1), while the lower one is for Channel 2 (CH2).

4.2 Description for Front Panel and Keys

See the following figure 3:

figure 3

Description:

1. Power adapter jack.
2. Serial port.
3. USB jack.

4. Backlight switch .
5. POWER: Power switch.
6. A: Multimeter current measurement key.
7. V: Multimeter voltage measurement key.
8. R: Multimeter resistance, triode, On/Off and capacitance measurement key.
9. OSC ◄: Oscilloscope left-direction adjustment key.
10. OSC ►: Oscilloscope right-direction adjustment key.
11. OSC OPTION: Oscilloscope setting key.

- With the combination application of the four keys OSC ◄, OSC ►, OSC ▲ and OSC ▼, the users can make the following settings circularly by pressing OSC OPTION. The settings include: Voltage Unit Scale of Channel 1 (CH1 VOL); Voltage Unit Scale of Channel 2 (CH2 VOL); Primary Time base (TIME BASE), zero point position of channel 1(CH1 ZERO), zero point position of channel 2(CH2 ZERO), trigger horizontal position (TIME) and trigger level position (TRIG).
- When performing Waveform Calculation, the users can also adjust and calculate the Display Multiplying Factor of waveform (CHM VOL) and the vertical display position (CHM ZERO).
- In cursor measurement mode, the users can adjust the positions of Cursor 1 (V1 or T1) and Cursor 2 (V2 or T2).

12. OSC ▼: Oscilloscope display downward adjustment key.
13. OSC ▲: Oscilloscope display upward adjustment key.
14. OSC/DMM: Operation mode switching key between oscilloscope and multimeter.
15. AUTO SET:

- Under the Multimeter Mode, when performing the current or voltage measurement, you can make a measurement switch between AC and DC with this key pressed; when performing the resistance measurement, you can select resistance, diode, On/Off or capacitance measurement circularly with this key.
- While this key is used for auto setting under the oscilloscope operation mode.

16. RUN/STOP: key for running or stopping the operation.
17. MENU ▼: Choose the lower item on the menu list.
18. MENU: Show / Hide the menu
19. MENU ▲: Choose the upper item on the menu list.
20. F1～F5: Switch or Adjust options for each menu.
21. 5v output port with a frequency of 1 kHz as the test-signal.

5.Using the Scope

5.1 About this Chapter

This chapter provides a step-by-step introduction to the scope functions. The introduction does not cover all of the capabilities of the scope functions but gives basic examples to show how to use the menus and perform basic operations.

5.2 Power-Up the Oscilloscope

Connect oscilloscope to AC power via a power adapter as shown in Figure 1. (The oscilloscope may still work with built-in Li-ion battery even without AC power supply)
Turn the oscilloscope on by pressing down the power on/off key **POW**.
The instrument then performs selfchecking after power on. A greeting window and a sentence "press any key to continue……" will display on the screen when the system finishes selfchecking.
The users can press any key to enter the measuring function.
The oscilloscope is powered up in its last setup configuration.

5.3 Oscilloscope Operation Window

See the following figure 4:

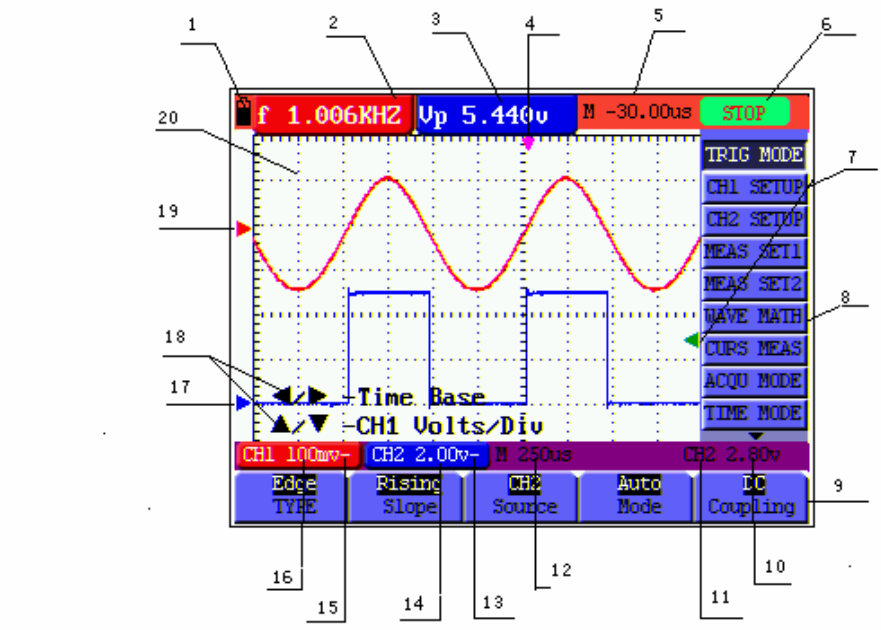


figure 4: Oscilloscope Operation Window

Description:

1. Battery electric quantity indicating symbols, including , , and .
2. Auto measurement window 1, in which “f ”means frequency, “T” means cycle, “V” means the average value, “Vp” the peak-peak value and “Vk” the root-mean-square value.
3. Auto measurement window 2.
4. The pointer indicates the horizontal triggering position.
5. This reading gives the Time Difference between the horizontal triggering position and the screen centerline. It reads zero when the pointer is in the center of the screen.
6. The trigger state indicates the following information.

   Auto: The oscilloscope is working in the automatic mode and displaying the waveform under the non-trigger state.

   Trig’d: The oscilloscope has detected a trigger and collecting the information generated after the trigger.

   Ready: All pre-triggered data have been captured and the oscilloscope has been ready to receive trigger signals.

   Scan: The oscilloscope can gather and display the waveform data continuously in scanning mode.

   Stop: The oscilloscope has stopped collecting the waveform data.
7. The green pointer shows the trigger voltage level.
8. A hidden-style menu: With the **MENU** key pressed, you can view or hide the menu.
9. Menu setting options: There are different setting options for different menus.
10. It reads the value of trigger voltage level.
11. The display shows the trigger signal source.
12. The reading gives the value of primary time base.
13. These graphics present the coupling modes of channel 2(CH2). The graphic “～” indicates AC, the graphic “－” indicates DC.
14. This reading shows the vertical Voltage Unit Scale of CH2.
15. These graphics show the coupling mode of CH1, among which the graphic “～” express indicates AC, the graphic “－” indicates DC.
16. This reading shows the vertical Voltage Unit Scale of CH1.
17. The blue pointer gives the grounding datum point of the waveform on CH2, which is the zero position of CH2. No display of this pointer indicates that the channel has not been opened.
18. OSC OPTION operation prompt: There are different prompts for different OSC OPTION

operations.

19. The red pointer gives the grounding datum point of the waveform on CH1, which is the zero position of CH1. No display of this pointer indicates that the channel has not been opened.

20. Waveform display area. Red waveform represent CH1, blue waveform represent CH2.

5.4 Navigating a Menu

The following example shows how to use the tool's menus to select a function, as shown in the following figure.

1. Press the **MENU** key to display the Function Menu on the right of the screen and the corresponding optional settings on the bottom. Press **MENU** again will hide the Function Menu.
2. Press the **MENU** ▲ or **MENU** ▼ key to select different function menus.
3. Choose one key from **F1** to **F5** and press it to change function setting.

See the following figure 5:

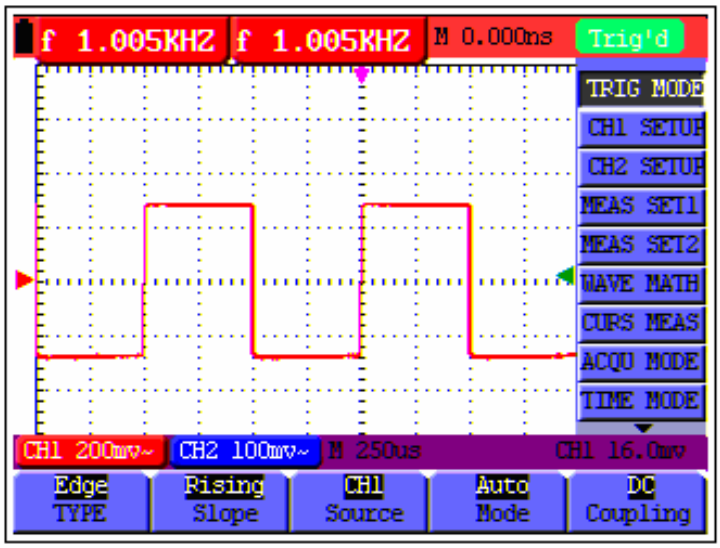


figure 5: the Tool's Menus

5.5 Manually Setting the Vertical System, Horizontal System and Trigger Position

With the combination application of the four keys **OSC** ◄, **OSC** ►, **OSC** ▲ and **OSC** ▼, the users can make the following settings circularly by pressing **OSC OPTION.** The settings include: Voltage Unit Scale of Channel 1 (**CH1 VOL**); Voltage Unit Scale of Channel 2 (**CH2 VOL**); Primary Time base (**TIME BASE**), zero point position of channel 1(**CH1 ZERO**), zero point position of channel 2(**CH2 ZERO**), trigger horizontal position (**TIME**) and trigger level position (**TRIG**).

The following example shows how to use **OSC OPTION** key to make a setting.

1. Press once the **OSC OPTION** key; the following is displayed at the bottom left side of the screen, as shown in the figure below.

   ◄/► – Time Base

   ▲/▼ – CH1 Volts/Div

See the following figure 6:

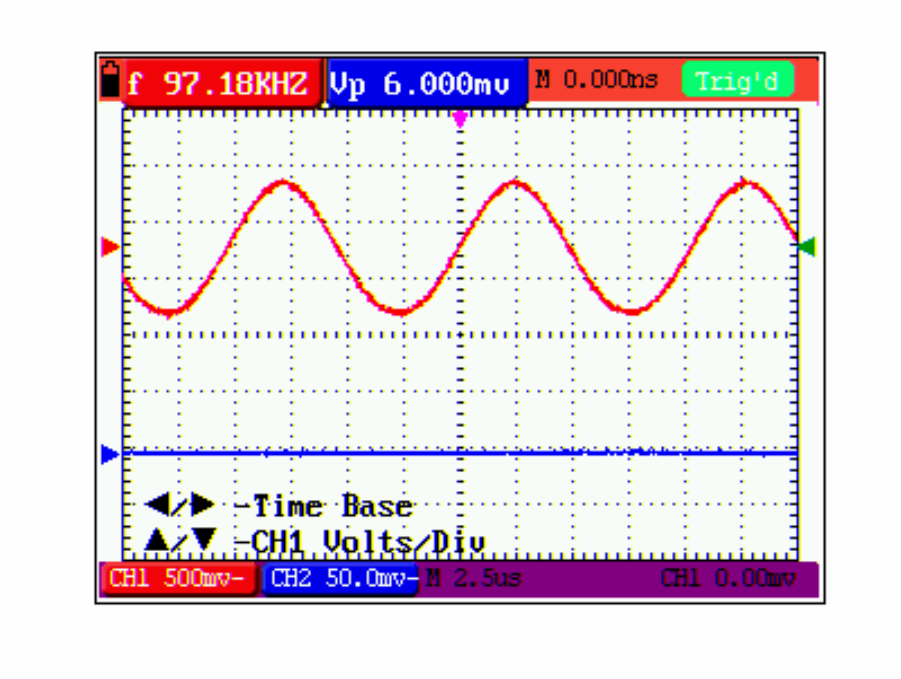


figure 6: Voltage Unit Scale of Channel 1

2. Press the key **OSC ▲** or **OSC ▼** to adjust the vertical scale of Channel 1 and press **OSC ◄**or **OSC ►** to adjust the horizontal time scale.

3. Press **OSC OPTION** once again, the following display is visible at bottom left side of the screen, as shown in the following figure.

   ◄/► – Time Base

   ▲/▼ – CH2 Volts/Div

See the following figure 7:

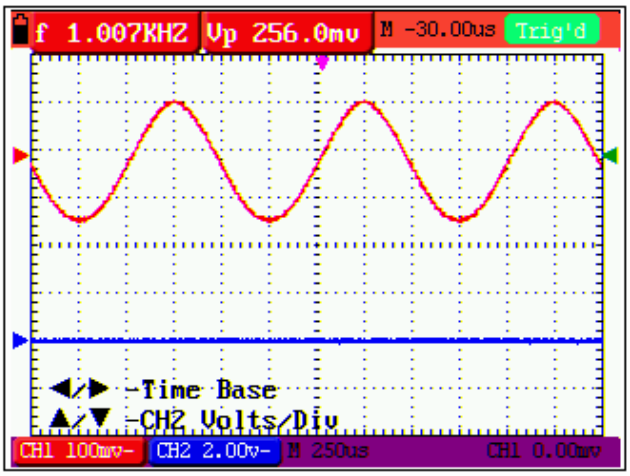


figure 7: Voltage Unit Scale of Channel 2

4. Press the **OSC ▲** or **OSC ▼** key to adjust the vertical scale of Channel 2 and press the **OSC◄** or **OSC ►** key to adjust the horizontal time scale.

5. Press the **OSC OPTION** key one more time, and the following display is visible at the bottom left side of the screen, shown as the following figure.

   ◄/► – Time

   ▲/▼– CH1 Zero

See the following figure 8:

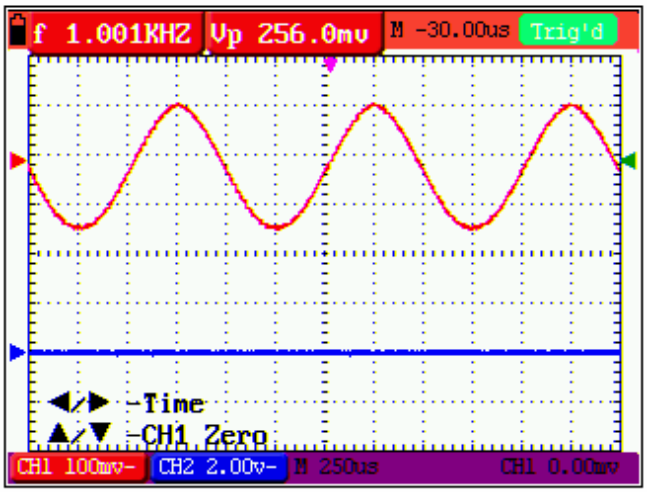


figure 8: Zero Point Position of Channel 1

6. Press **OSC** ▲ or **OSC** ▼ key to adjust the zero position of Channel 1 in vertical direction and press **OSC** ◄ or **OSC** ► key to adjust the horizontal position.

7. Again, press **OSC OPTION** key and the following appears at the bottom left side of the screen, shown as the following figure.

   ◄/► – Time

   ▲/▼ – CH2 Zero

See the following figure 9:

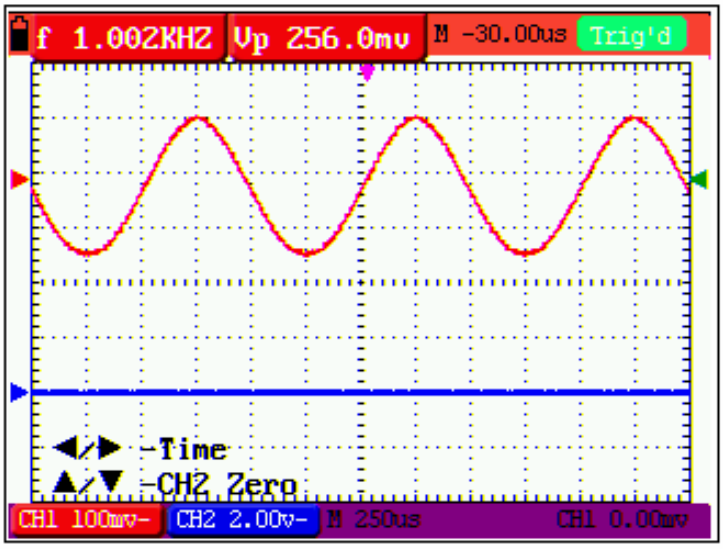


figure 9: Zero Point Position of Channel 2

8. Press the **OSC** ▲ or **OSC** ▼ key to adjust the zero position of Channel 2 in the vertical direction and press **OSC** ◄ or **OSC** ► key to adjust the horizontal position.

9. Press **OSC OPTION** key once more and the following appears at the bottom left of the screen, shown as the following figure.

   ◄/► – Time

   ▲/▼ – Trig

See the following figure 10:

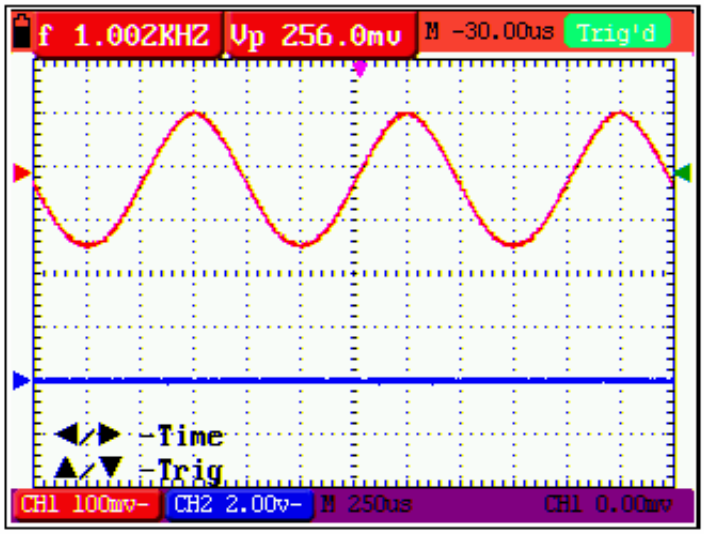


figure 10: Trigger Level Position

10. Press the **OSC** ▲ or **OSC** ▼ key to adjust the trigger position of Channel 2 and press **OSC** ◄ or **OSC** ► key to adjust the horizontal position.

11. Press the **OSC OPTION** key again and return back to step 1.

Term interpretation

- **Vertical scale factor:** It stands for the voltage amplitude represented by a division in the vertical direction of the display area, through the adjustment of which you can amplify or attenuate the signal and thus regulate the signal amplitude into the expected measurement range.
- **Vertical zero position:** It is referred to as the grounding datum point, through the adjustment of which you can regulate the display position of the waveform on the screen.
- **Primary time base:** It means the time values represented by a division in the horizontal direction of the display area.
- **Trigger horizontal position:** It means the time deviation between the actual trigger point and the screen central line, which will be displayed as 0 at the center point of the screen.
- **Trigger level position:** It represents the voltage deviation between the actual trigger level and the zero position of the triggering signal source channel.

5.6 Resetting the Oscilloscope

If you want to reset the Oscilloscope to the factory settings, do the following:

1. Press **MENU** key and the function menu appears on the right side of the screen

2. Press the **MENU ▲** or **MENU ▼** key to select function setting and three options are visible at the bottom of the screen.

3. Press **F1** key to select the factory settings. The oscilloscope is set to be the factory settings.

See the following figure 11:

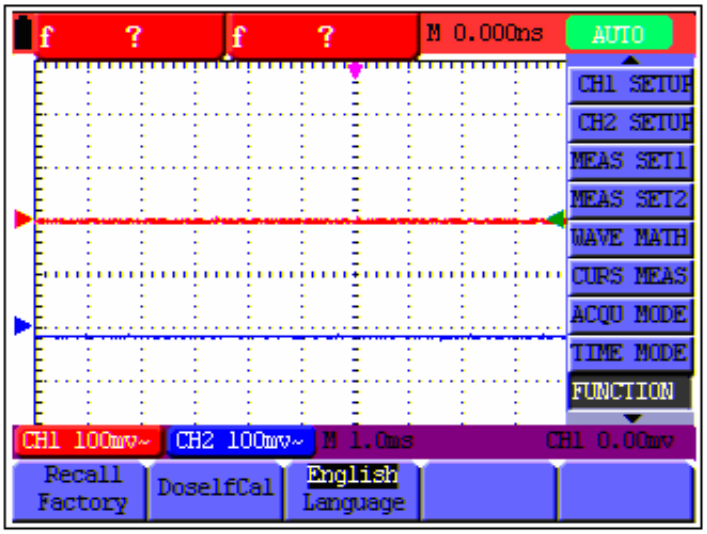


figure 11: Reset the Oscilloscope

5.7 Input Connections

See figure 2.

Look at the bottom and the right of the Oscilloscope. The Oscilloscope has seven signal inputs: two safety BNC jack inputs (CH1 and CH2) for scope measurements, three safety 4-mm banana jack inputs for Multimeter R, V and A measurements, and two quadratic jack inputs for Multimeter capacitance measurements.

Isolated input allows independent floating measurements between Multimeters and Scopes.

5.8 Displaying an Unknown Signal with Auto Set

The Auto-Set feature lets the Oscilloscope display and measure unknown signals automatically. This function optimizes the position, range, time base, triggering and assures a stable display of virtually any waveform. . This feature is especially useful for quickly checking several signals.

To enable the Auto-Set feature, do the following:

1. Connect the test probe to the tested signals.

2. Press the **AUTO SET** key and the Oscilloscope is under the automatic measurement condition. The tested signals appear on the screen.

5.9 Automatic Zero-returning of Trigger Horizontal Position and Trigger Level Position

When we adjust the trigger horizontal position and trigger level position to be maximal to make it off the screen center remotely, then we perform the following steps to make trigger horizontal position and trigger level position return to zero automatically.

1. Press **OSC** ◄ key and **OSC** ► key simultaneously, the trigger horizontal position automatically returns to zero.
2. Press **OSC** ▲key and **OSC** ▼key simultaneously, the trigger level position automatically returns to zero.

5.10 Automatic Measurements

The Oscilloscope offers 5 ranges of automatic scope measurements. Your can display two numeric readings: **measurement 1** and **measurement 2**. These readings are selectable independently, and the measurements can be done on the input CH1 or input CH2 waveform.

To choose a frequency for CHI1, do the following:

1. Press **MENU** key and the function menu appears on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select **measurement 1**. Five items selectable are visible at the bottom of the screen.
3. Press **F1** key and select **Freq CH1** from the mean square root value item. The **measurement 1** window turns its color into red and shows the frequency for input CH1.

To choose a Peak-Peak measurement for Input CH2, do the following:

1. Press **MENU** key and the function menu is displayed on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key and select **measurement 2**, with 5 items selectable displayed at the bottom of the screen.
3. Press **F4** key to select **PK-PK CH2** from Peak-Peak item. The **measurement 2** window turns its color to be blue and shows the peak-peak value for input CH2.

See the following figure 12:

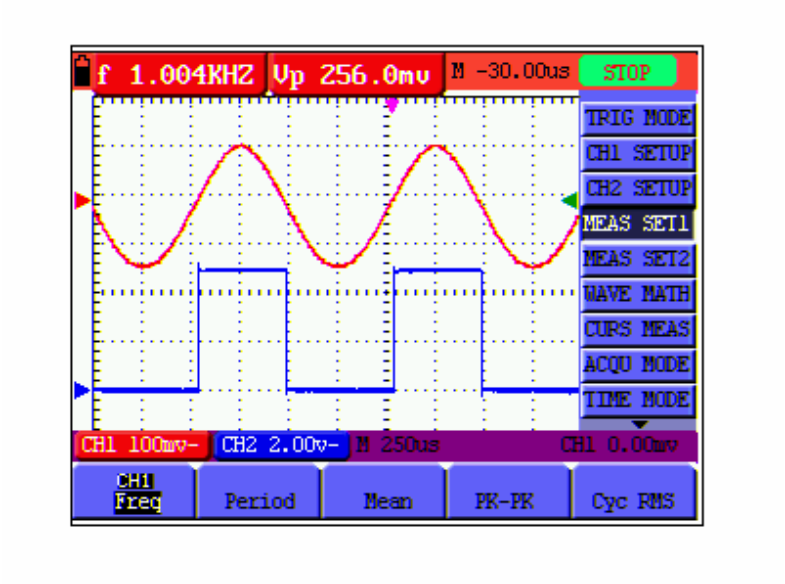


figure 12: Automatic Scope Measurements

5.11 Freezing the Screen

You can freeze the screen (all readings and waveforms)

1. Press the **RUN/STOP** key to freeze the screen and **STOP** appears at top right side of the screen.

2. Press the **RUN/STOP** key once more to resume your measurement.

See the following figure 13:

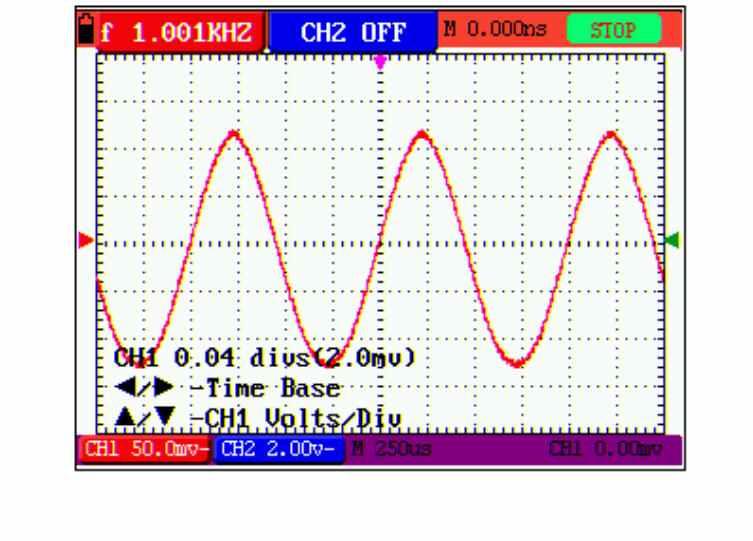


figure 13: Freezing the Screen

Using Average for Smoothing Waveforms

To smooth the waveform, do the following:

1. Press the **MENU** key and the function menu appears on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select **ACQU mode**, with four items selectable displayed at the bottom of the screen.
3. Press the **F3** key to select **Average Factors**, then, press **F4** key to jump to **Averaging 16** item. This averages the outcomes of **16 a**cquisitions and shows the final averaging result on the screen, shown as the following figures.

See the following figure 14:

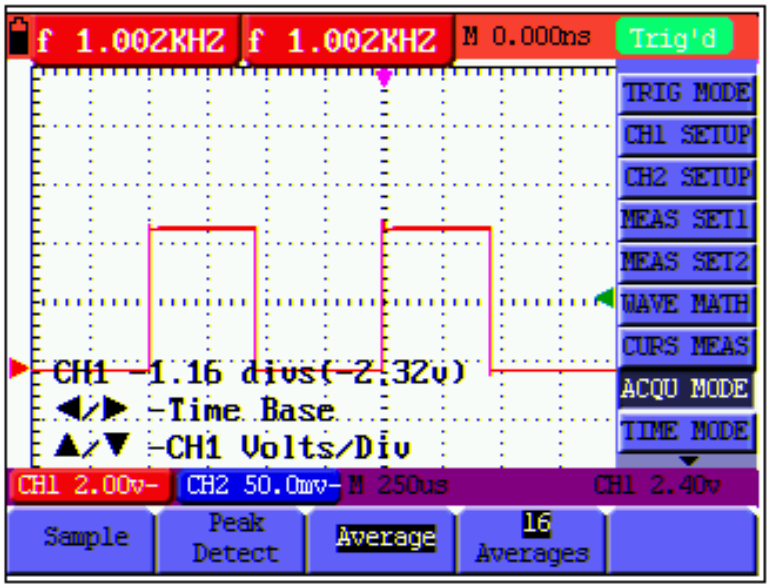


figure 14: Average Factor Sampling Mode

5.13 Using Persistence to Display Waveforms

You can use Persistence to observe dynamic signals.

1. Press **MENU** key and the function menu appears on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select **DISP SET.** Four items selectable are displayed at the bottom of the screen.
3. Press **F2** key to select Persist **1 sec, 2 sec, and 5 sec, infinite or close**. In this case, jump to **Infinite** and the observed dynamic is kept on the screen continuously. When the item **Close** is selected, the **Persistence** function is closed.

Look at the display, a screen like the following figure 15 can be shown.

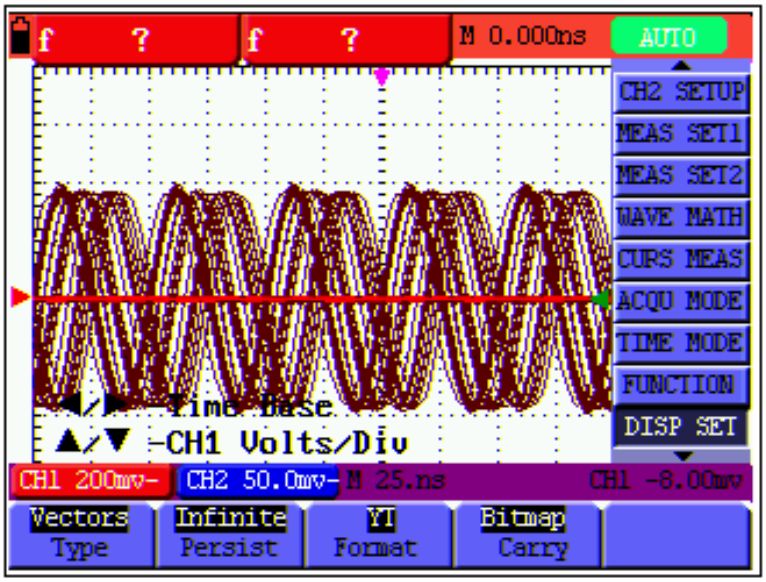


figure 15: Persistence to Observe Dynamic Signals

5.14 Using Peak Detection to Display Glitches

You can use this function to display events (glitches or other asynchronous waveforms) of 50 ns or wider.

1. Press **MENU** key and the function menu appears at the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select the **ACQU MODE**. Four items selectable are displayed at the bottom of the screen.
3. Press **F2** key and jump to Glitch Detect. In this case, you can test the glitch.

Now, you can see a screen that looks like the following figure 16.

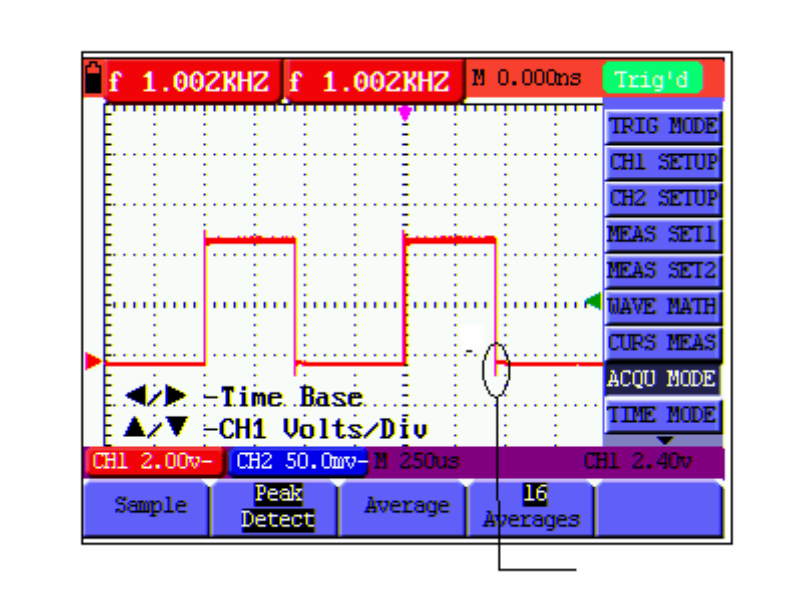


figure 16: Peak Detection

Term interpretation

Collecting mode: The oscilloscope transforms the collected analog data into a digital form after they are gathered in the following three different modes, such as sampling, peak value detection and averaging values.

Sampling: The oscilloscope takes samples from the signal at a equal time interval to reconstruct the waveform in this mode, by which the analog signal can be expressed correctly in most cases, yet, the rapid changes can not be collected between two sampling time intervals, causing the confusion and loss the narrow pulse in the signal probably.

Peak value detection: The oscilloscope takes samples from the maximum and minimum of signals in each sampling interval and shows the waveform with the sampled data in this mode, thus, by which the oscilloscope may collect the possibly lost narrow pulse in the sampling mode but the noise is obvious.

Averaging values: the oscilloscope collects several waveforms and average over them, and displays the averaged waveform in this mode, by which the random noise can be reduced.

Duration time: When a new waveform is displayed, the previous waveform shown on the screen does not disappear immediately only to be displayed for a period of time, that is, the duration time, by setting which, the waveform can be displayed more continuously and thus a display similar to that shown by the analog oscilloscope can be achieved.

Roll scan mode: The oscilloscope updates the waveform sampling points by scrolling display through a screen from left to right in this mode, which is only applicable to the primary time base setting of above 50ms.

5.15 Selecting AC-coupling

After a reset, the Oscilloscope is dc-coupled so that ac and dc voltages appear on the screen, Use ac-coupling when you wish to observe a small ac signal that rides on a dc signal. To select ac-coupling, do the following:

1. Press **MENU** key and the function menu appears at the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select the **CH1 Setting.** Four items selectable are visible at the bottom of the screen.
3. Press the **F1** key and jump to AC. The bottom left side of the screen displays the ac-coupling icon.

Now, you can see a screen that looks like the following figure 17.

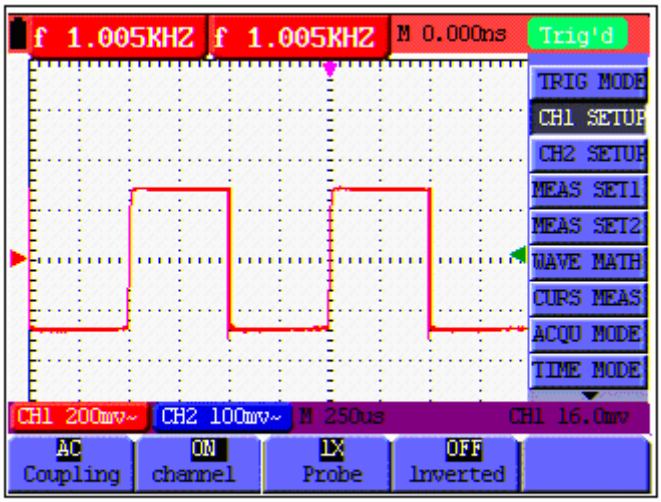


figure 17: AC-Coupling

5.16 Reversing the Polarity of the Displayed Waveform

To invert the input CH1 waveform, do the following:

1. Press the **MENU** key and the function menu appears at the right side of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to select CH1 setting. Four items selectable are displayed at the bottom of the screen.
3. Press **F4** key to jump to **Inverted.** The inverted waveform of CHI1 is displayed on the screen.

Now, you can see a screen that looks like the following figure 18.

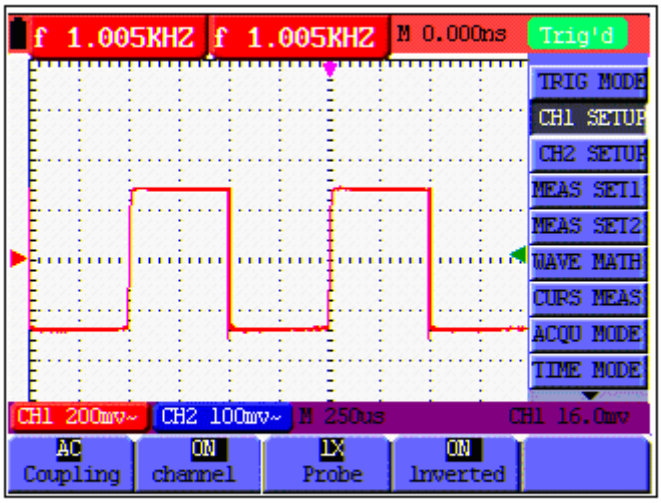


figure 18: Inverted On

5.17 Using Waveform Mathematics Functions

When adding (CH1 + CH2), subtracting (CH1 – CH2, CH2 – CH1), multiplying (CH1 * CH2) or dividing （CH1 / CH2） the input waveforms of CHI and CH2, the Oscilloscope will display the mathematical result waveform M and the input waveforms of CH1 and CH2 on the screen. The Mathematics functions perform a point-to-point calculation on the waveforms CH1 and CH2.
To use a Mathematics function, do the following:

1. Press the **MENU** key and the function menu is displayed at the right side of the screen.

2. Press the **MENU** ▲ or **MENU** ▼ key to select the **Waveform Calculation.** Five items selectable appears at the bottom of the screen.

3. Press **F3** key to select **CH1+CH2** and the calculated waveform M (green) appears on the screen. Again, press the **F3** key to close Waveform Calculation.

4. In this case, press the **OSC OPTION** key and the following is visible at the bottom left side of the screen.

   ◄/► Time

   ▲/▼ CHM Zero

   Then, press the **OSC** ▲ or **OSC** ▼ key to adjust the vertical position of the calculated waveform M displayed on the screen.

5. Press the **OSC OPTION** key and the following appears at the bottom left side of the screen.

◄/► Time Base

▲/▼CHM Volts/Div

Press the **OSC** ▲ or **OSC** ▼ key to adjust the displayed amplitude of the calculated waveform M.

Now, you can see a screen that looks like the following figure 19.

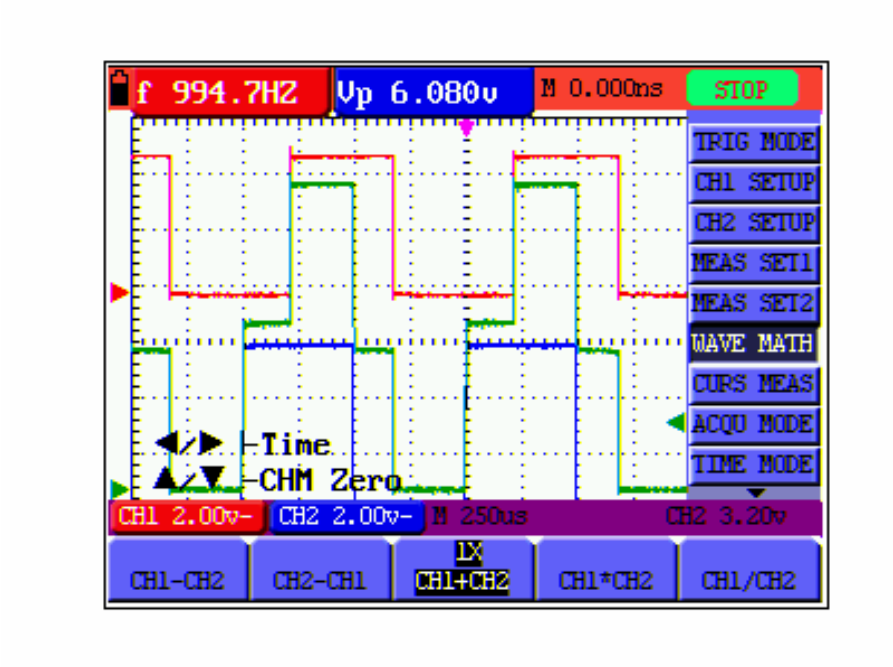


figure 19: Waveform Mathematics

6.Using the Multimeter

6.1 About this Chapter

This chapter provides a step-by-step introduction to the multi-meter functions of the test tool hereafter. The introduction gives basic examples to show how to use the menus and perform basic operations.

6.2 Making Meter Connections

Use the three 4-mm safety banana jack inputs for the Meter functions: COM, V/Ω, mA.

Two quadratic capacitance jacks: CX

See figure 2 for the connections.

6.3 Multimeter Operation Window

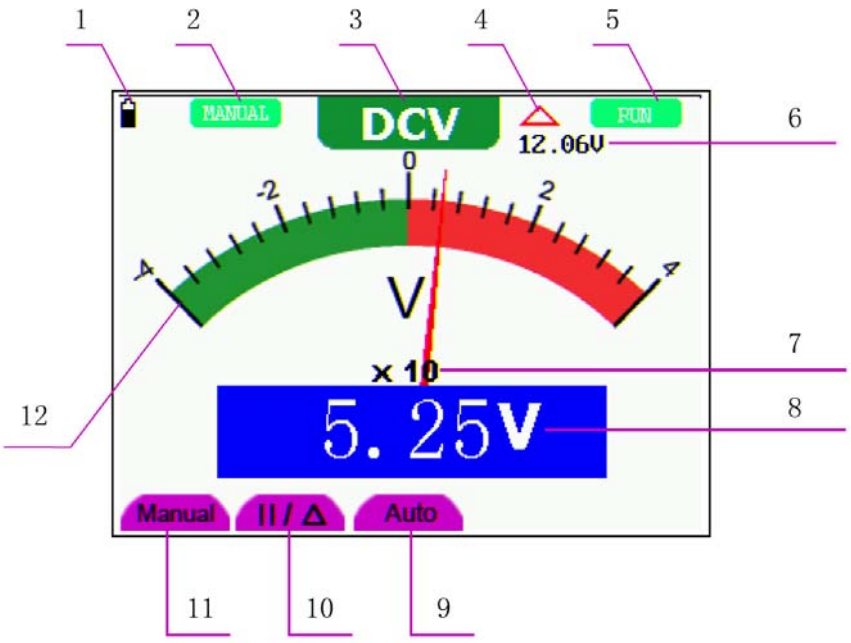


figure 20: Multimeter Operation Window

Description

1. Battery electric quantity indictor.
2. Manual/Auto range indictors, among which the MANUAL means measuring range in manual

operation mode and Auto refers to the measuring range in automatic operation mode.

3. Measurement mode indicators:

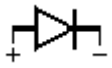
   DCV: Direct voltage measurement

   ACV: Alternating voltage measurement

   DCA: Direct current measurement

   ACA: Alternating current measurement

   R: Resistance measurement

 : Diode measurement

: On/Off measurement

   C: Capacitance measurement

4. The relative magnitude measurement indicator.
5. Running state indicators, among which RUN expresses continuous update and STOP represents the screen locking.
6. The reference value of the relative magnitude measurement.
7. The multiplying power of the dial indication. To multiply the reading of dial pointer by multiplying power will get the measurement result.
8. The mail reading of measurement
9. Automatic control measuring range.
10. Absolute/ relative magnitude measuring control: The sign "||" expresses the absolute magnitude measuring control and "△" represents the relative magnitude measuring control.

    Manually measuring range control.

11. Manual measurement control.
12. Test lead indicated the scale of test reading, different test modes display different colors.

6.4 Making Multimeter Measurements

Press **DMM/OSC** key, the oscilloscope will switch to the multimeter measure, the screen will display the multimeter windows, at the same time, prompt to correctly insert testing pen of the multimeter, at this time, then press any key to enter into multimeter measure.

6.4.1 Measuring Resistance Values

To measure a resistance, do the following:

1. Press the **R** key and **R** appear at the top of the screen.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω** banana jack input.
3. Connect the red and black test leads to the resistor. The resistor value readings are shown on the screen in Ohm.

Now, you can see a screen that looks like the following figure 21.

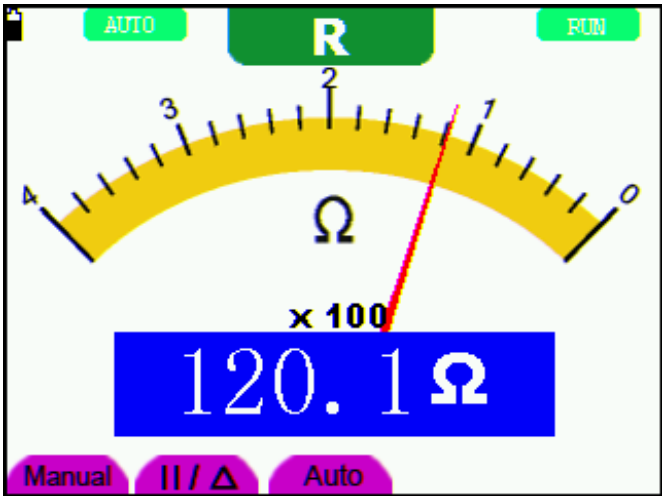
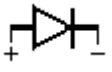


figure 21: Resistance Measurement

6.4.2 Making a Diode Measurement

To make a measurement on the diode, do the following:

1. Press the **R** key and **R** appear at the top of the screen.
2. Press **AUTO SET** key till the following is displayed on the screen  .
3. Insert the black lead into the **COM** banana jack input and the red lead into the V/Ω banana jack input.
4. Connect the red and black leads to the resistor and the diode resistor readings are displayed on the screen in **V**.

Now, you can see a screen that looks like the following figure 22.

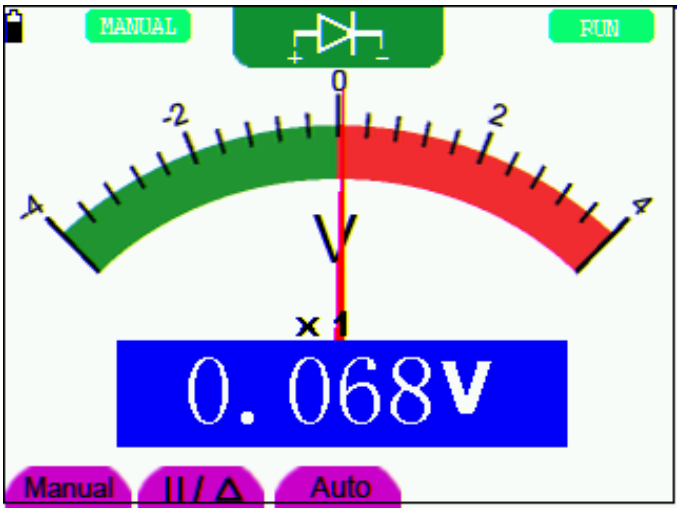


figure 22: Diode Measurement

6.4.3 On-off Test

To perform an On-off test, do the following:

1. Press the **R** key and **R** appears on the top of the screen.
2. Press the **AUTO SET** key till the following is shown on the screen.
3. Insert the black lead into the **COM** banana jack input and the red lead into the **V/ Ω** banana jack input.
4. Connect the red and black leads to the test point. If the resistance value of the tested point is less than 50 Ω , you will hear beep sound from the test tool.

Now, you can see a screen that looks like the following figure 23.

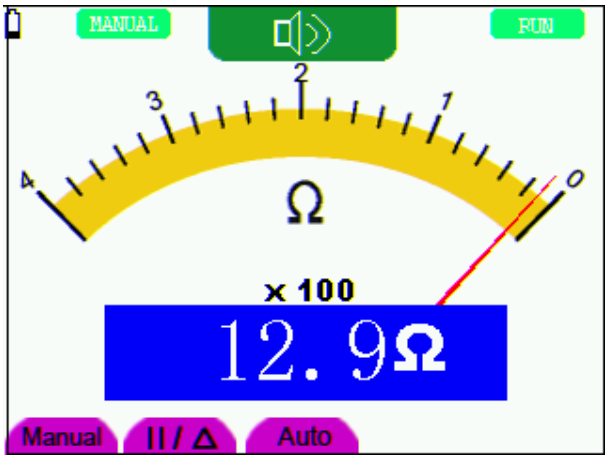


figure 23: On-off Test

6.4.4 Making a Capacitance Measurement

To measure a capacitance, do the following:

1. Press the **R** key and **R** appears on the top of the screen
2. Press the **AUTO SET** key till **C** appears at the top of the screen.
3. Insert the measured capacitance into the quadratic jack and the screen shows the capacitance reading.

Notice: when measured value is less than 5 nF capacitance, please use small capacitance measurer of this multimeter and use relative value measuring mode to improve measuring precision. It will take about 30seconds if capacitance measurement is large than 40uF.

Now, you can see a screen that looks like the following figure 24.

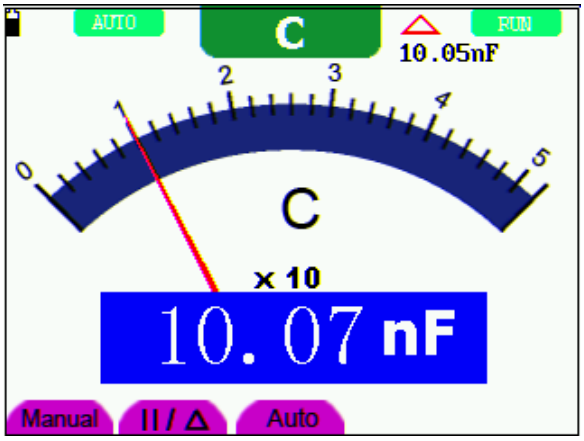


figure 24: Capacitance Measurement

6.4.5 Making a DC Voltage Measurement

To measure a DC voltage, do the following:

1. Press the **V** key and **DCV** appears at the top of the screen.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω** banana jack input.
3. Connect the red and black leads to the measured point and the measured point voltage value is displayed on the screen.

Now, you can see a screen that looks like the following figure 25.

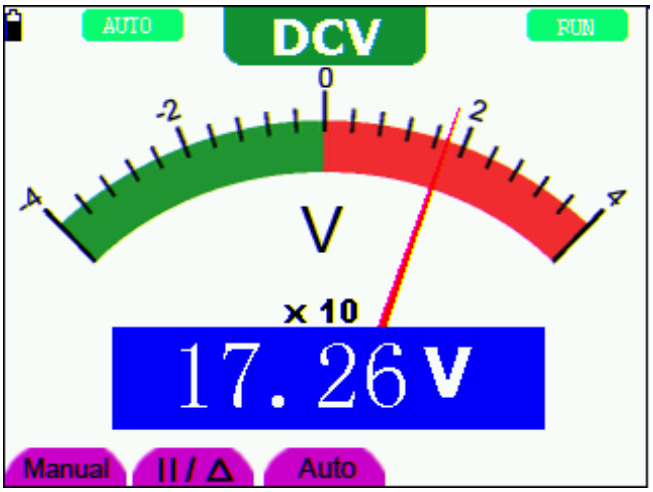


figure 25: DC Voltage Measurement

6.4.6 Making a AC Voltage Measurement

To measure the AC voltage, do the following:

1. Press the **V** key and **DCV** appears at the top of the screen.
2. Press the **AUTO SET** key and **ACV** appears at the top of the screen.
3. Insert the black lead into the **COM** banana jack input and the red lead into the **V/Ω** banana jack input.
4. Connect the red and black leads to the measured points and the AC voltage values of measured points will be displayed on the screen.

Look at the display, you can see a screen that looks like the following figure 26.

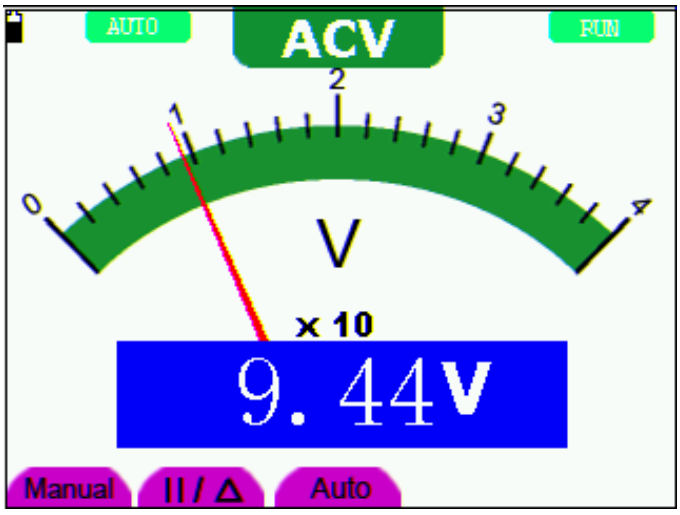


figure 26: AC Voltage Measurement

6.4.7 Making a DC Current Measurement

To measure a DC current which is less than 400 mA , do the following:

1. Press the A key and DCA appears at the top of the screen. The unit on the main reading screen is **mA. mA** and **20A** will display on the right bottom of screen, press F4 or F5 to switch the measurement between **mA** and **20A**. 400mA is acquiescently.
2. Insert the black lead into the **COM** banana jack input and the red lead into the **mA** banana jack input.
3. Connect the red and black leads to the measured points and the DC current values of measured points will be displayed on the screen.

Look at the display, you can see a screen that looks like the following figure 27.

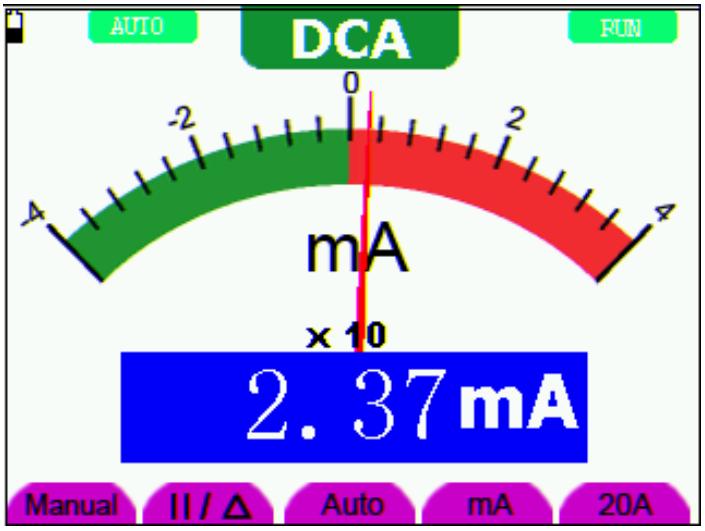


figure 27: DC Current Measurement for 400 mA

To measure a DC current which is larger than 400 mA, do the following:

1. Press the **A** key and **DCA** appears at the top of the screen. The unit on the main reading screen is **mA**..
2. Press **F5** key change to **20A** measurement, the unit on the main reading screen is **A.**
3. Plug current extended module in current measure jack, then plug the probe in the module
4. Connect the red and black leads to the measured point and the **DC** current value of the measured point will be displayed on the screen.
5. Press F4 return to 400 mA measure.

Look at the display, you can see a screen that looks like the following figure 28.

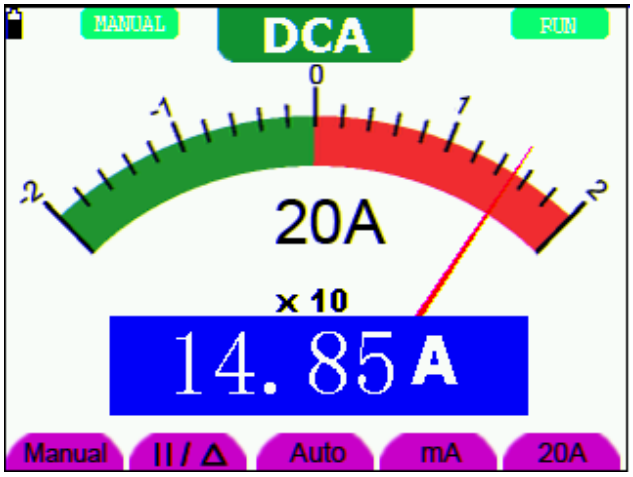


figure 28: DC Current Measurement for 20A

6.4.8 Making an AC Current Measurement

To measure an AC current which is less than 400 mA, do the following:

1. Press the **A** key and **DCA** appears at the top of the screen. The unit on the main reading screen is **mA. mA** and **20A** will display on the right bottom of screen, press **F4** or **F5** to switch the measurement between **mA** and **20A**. 400mA is acquiescently.
2. Press the **AUTO SET** key once and ACA is visible at the top of the screen..
3. Insert the black lead into the **COM** banana jack input and the red lead into the **mA** banana jack input.
4. Connect the red and black leads to the measured point and the **AC** current value of the measured point will be displayed on the screen.

Look at the display, you can see a screen that looks like the following figure 29.

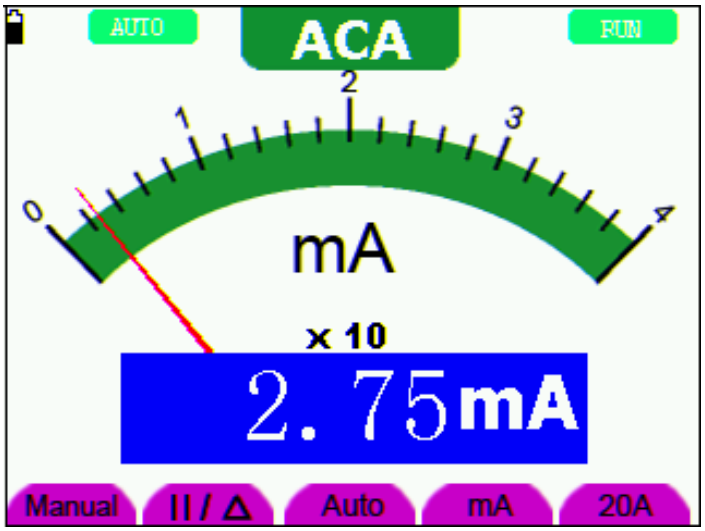


figure 29: AC Current Measurement for 400 mA

To measure an AC current which is larger than 400 mA, do the following:

1. Press the **A** key once and DCA is visible on the top of the screen.
2. Press **F5** to select **20A** measure, the unit of main reading window is **A.**
3. Press the **AUTO SET** key once and ACA is visible on the top of the screen.
4. Plug current extended module in current measure jack, then plug the probe in the module.
5. Connect the red and black leads to the measured point and the **AC** current value of the measured point will be displayed on the screen.
6. Press **F4** return to 400mA measure.

Look at the display, you can see a screen that looks like the following figure 30.

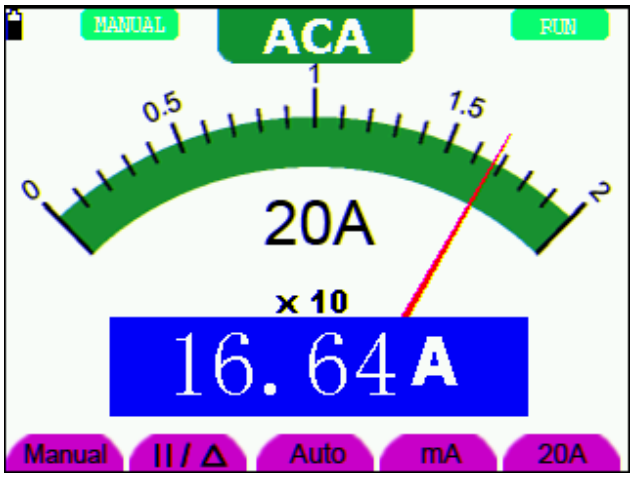


figure 30: AC Current Measurement for 20A

6.5 Freezing the Readings

You can freeze the displayed readings at any time.

1. Press the **RUN /STOP** key to freeze the screen and **STOP** will be displayed at the top right of the screen.
2. Again, press the **RUN /STOP** key, you can resume your measurement.

Look at the display, you can see a screen that looks like the following figure 31.

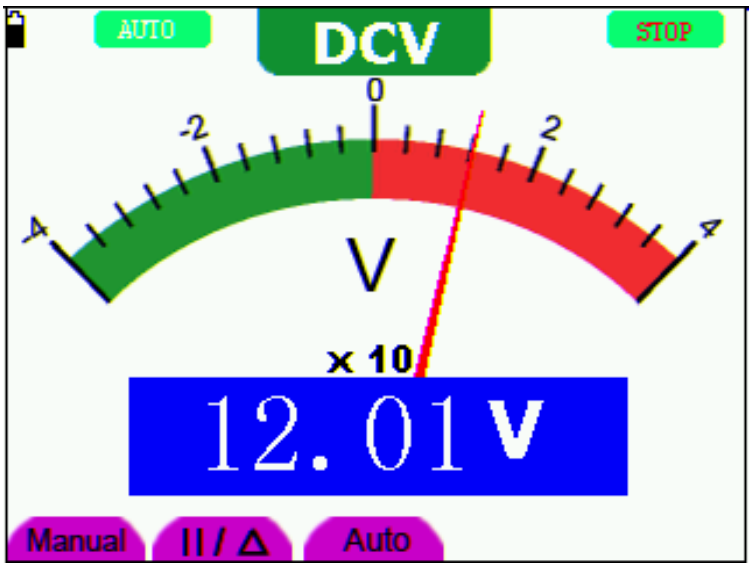


figure 31: Freezing the Readings

6.6 Taking a Relative Measurement

A currently measured result relative to the defined reference value is displayed in a relative measurement.

The following example shows how to take a relative measurement. At first, it is required to acquire a reference value.

1. Press **R** key and **R** is displayed on the top side of the screen.
2. Press the **AUTO SET** key till **C** appears at the top of the screen.
3. Plug capacitance extended module in capacitance measure jack.
4. When the reading leveling off, press **F2** key and △ is displayed on the top side of the screen. The saved reference value is displayed below △.
5. Plug capacitance, the displayed major reading on the screen is actual the capacitance value.

Look at the display, you can see a screen that looks like the following figure 32.

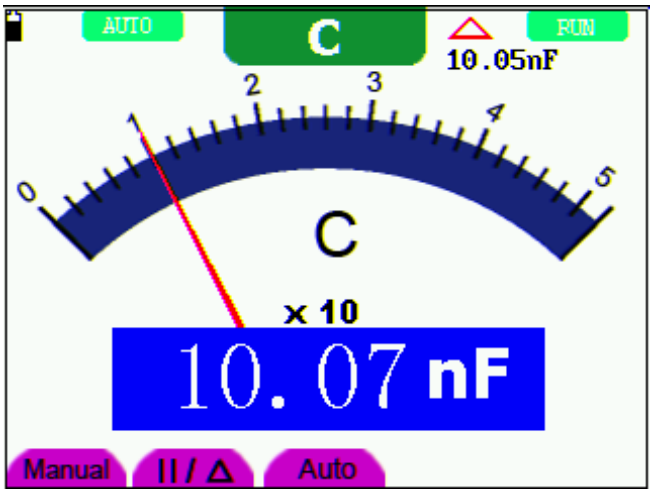


figure 32: Relative Measurement

6.7 Selecting Automatic/ManualRange Adjustment

The defaulted range mode of the instrument is automatic range. To switch to the manual range, perform the following steps:

1. Press **F1** key and **MANUAL** is displayed on the top left side of the screen to enter the manual range mode.
2. Under the manual range mode, the measuring range is increased by a stage when pressing **F1** key each time, and when reaching the highest stage, it jumps to the lowest stage by pressing F1 key once again. To multiply the reading of dial pointer by multiplying power and the unit of main reading on the screen will get the measurement result.
3. Press **F3** key and **AUTO** is displayed on the top left side of the screen to switch back to the automatic range mode.

Look at the display, you can see a screen that looks like the following figure 33.

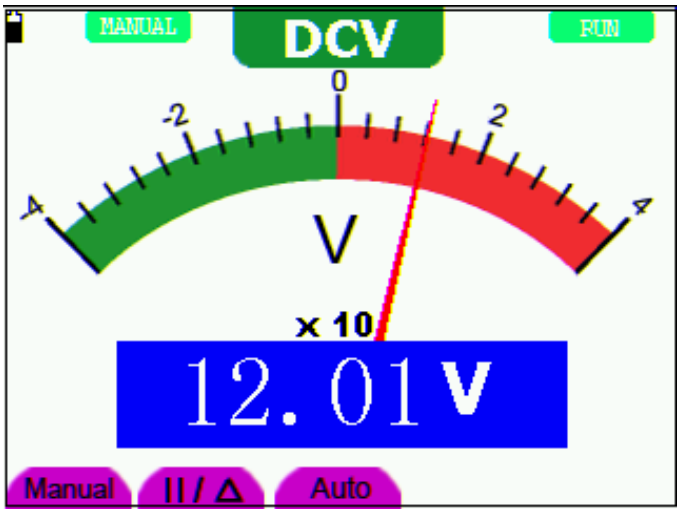


figure 33: Automatic/Manual Range Adjustment

Attention:capacitance measurement without manual range mode.

7.Advanced Function of Oscilloscope

7.1 About this Chapter

This chapter will detail the oscilloscope function of the test tool.

7.2 Setting the Vertical CH1 and CH2

Each channel has its own independent vertical menu and each item can be set respectively based on the specific channel.

To make vertical CH1 and CH2 settings, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to jump to **CH1 Setting** and 4 options appears at the bottom of the screen.
3. Select and press key from **F1** through **F4** keys to make different settings.

Now, you can find a screen that looks like the following figure 34.

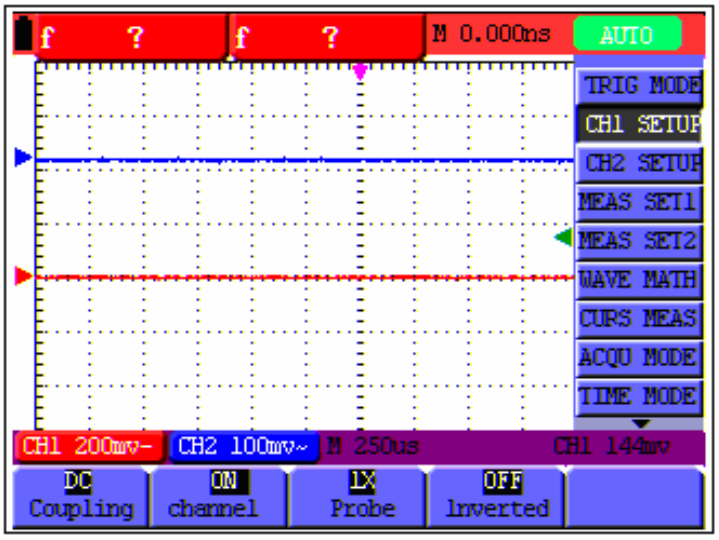


figure 34: Setting the Vertical

The following Table describes the **Vertical Channel** menu:

Function menu	Setting	Description
Coupling	AC DC Ground	The DC component in the input signal is blocked.. The AC and DC components of the input signal are allowed. Input signal is interrupted.
Channel	OFF ON	Close the channel. Open the channel.
Probe	1X 10X 100X 1000X	Select one according the probe attenuation factor to ensure a correct vertical scale reading.
Inverted	OFF ON	Waveform is displayed normally. Open the **Invert** function of the waveform setting.

7.2.1 Setting the Channel Coupling

With CH1 taken for example, the measured signal is a sine wave signal containing a DC offset. Press **F1 Coupling** first and then **AC** to make an ac coupling setting. The DC component contained in the tested signal is blocked.

Press **F1 Coupling** first and then **DC** to make a DC coupling setting. Both dc and ac components contained in the tested signal are permitted.

The waveform is displayed as the following figure 35, figure 36.

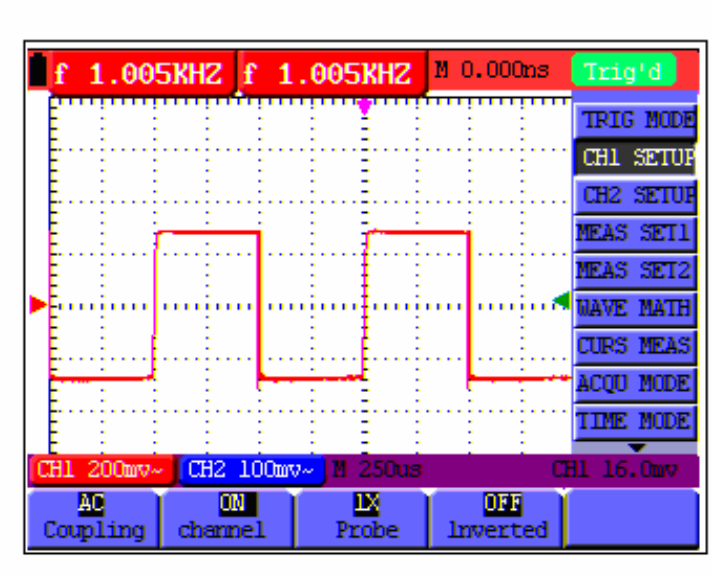


figure 35: AC Coupling

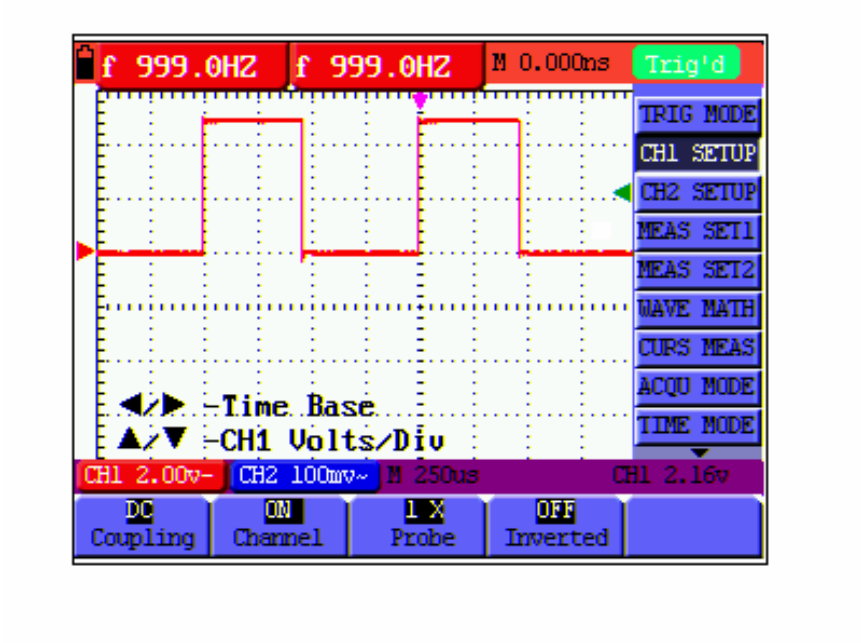


figure 36: DC Coupling

7.2.2 Make Open and Close Settings on Channel

Take CH1 as an example**.**

Press **F2 Channel** key first, then press **OFF** to make a Close setting on CH1.

Press **F2 Channel** key first, then press **ON** to make an Open setting on CH1.

7.2.3 Adjusting the Probe Scale

It is necessary to adjust the probe attenuation scale factor correspondingly in the channel operation menu in order to comply with the probe attenuation scale. If it is a 10:1 probe, the scale of the input channel of the oscilloscope should be selected as **10X** to avoid any error occurring in the displayed scale factor information and tested data.

Press **F3 Probe** to jump to the relative probe.

Table: Probe attenuation factor and the corresponding menu setting

Probe attenuation factor	Corresponding Menu Setting
1:1	1X
10:1	10X
100:1	100X
1000:1	1000X

7.2.4 Setting of Inverted Waveform

Inverted waveform: The displayed signal reverses 180 degrees relatively to the ground potential.

Press **F4 Invert** to start Invert; again press **F4 Invert** to close Invert.

7.3 Make the Math Function Menu Setting

The **MATH** functions in showing the result of adding, subtracting, multiplying or dividing calculation on CH1 and CH2 channel waveforms. Also, the result of arithmetic operation can be measured with grid or cursor. The amplitude of the calculated waveform can be adjusted with CHM VOL, which is displayed in the scale factor form. The amplitude ranges from 0.001 through 10 and steps in the 1-2-5 form, that is, it can be expressed as 0.001X, 0.002X, 0.005X…10X. The position of the calculated waveform can be adjusted up and down with the **CHM ZERO** key used.

The corresponding operation function table

Setting	**Description**
CH1-CH2	CH1 waveform minus CH2 waveform.
CH2-CH1	CH2 waveform minus CH1 waveform
CH1+CH2	Add CH1 waveform into CH2 waveform.
CH1*CH2	Multiply CH1 waveform and CH2 waveform.
CH1/CH2	Divide CH1 waveform by CH2 waveform.

To perform the **CH1+CH2** waveform calculation, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the MENU ▲ or MENU ▼ key to select MATH and 5 options are displayed at the bottom of the screen.
3. Press the **F3 CH1+CH2** key and the obtained waveform **M** appears on the screen. Again, press the F3 key and Close the waveform **M**.
4. Press the **OSC OPTION** key and the following is displayed on the screen:

   ◄/► – Time Base

   ▲/▼ –CHMath Volts/Div
5. Press the **OSC** ▲ or **OSC** ▼ key to adjust the amplitude of the waveform **M**.
6. Again, press the **OSC OPTION** key twice and the screen shows the following:

   ◄/► – Time

   ▲/▼ – CHM Zero
7. Press the **OSC** ▲ or **OSC** ▼ key to adjust the position of the waveform M.

Now, look at the display and you will find a screen that looks like the following figure 37.

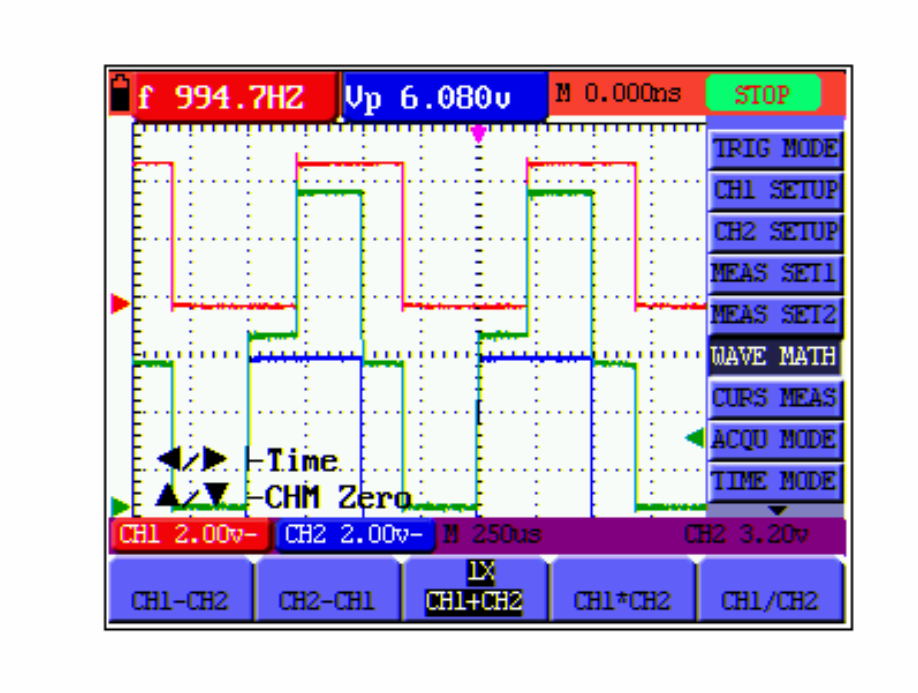


figure 37: Waveform Mathematics

7.4 Setting the Trigger System

The Trigger defines the time when the acquisition of data and display of waveform start. If it is set correctly, the trigger can turn an unstable display into a significant waveform.

When starting the acquisition of data, the oscilloscope collects sufficient data to draw the waveform at the left side of the triggering point. With waiting for the triggering condition, the oscilloscope is gathering data continuously. After a trigger is detected, the oscilloscope gathers enough data continuously to draw the waveform at the right side of the triggering point.

To make a trigger mode setting, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to select TRIG MODE and five items selectable are displayed at the bottom of the screen.
3. Select and press one from **F1 through F5** key to make a different setting.
4. Press the **OSC OPTION** key and the following is shown on the screen:

   ◄/► – Time

   ▲/▼ – Trig
5. Press the **OSC** ▲ or **OSC** ▼ key to adjust the trigger level position.

Now, look at the display, you can see a screen in the following figure38.

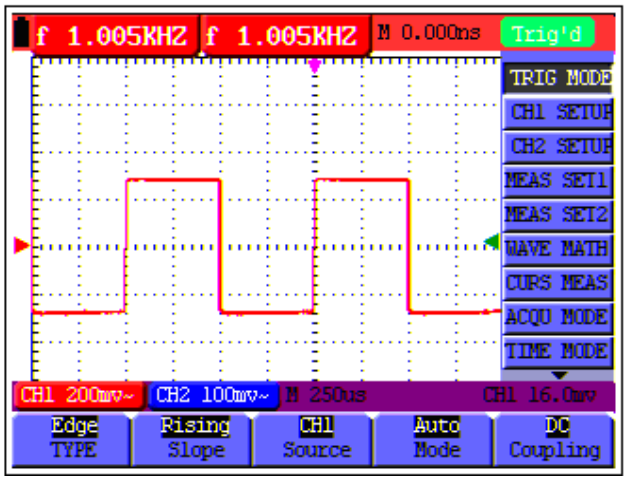


figure 38: Edge Trigger

7.5 Triggering Control

There are two triggering modes including Edge triggering and Video triggering. Each trigger mode is set by different function menu.

Edge triggering: It occurs when the trigger input passes through a given level along the specified direction.

Video triggering: Perform video field trigger or line trigger on the standard video signals.

The following describes the Edge triggering and Video triggering menus respectively.

7.5.1 Edge Triggering

The Edge triggering is a mode by which trigger occurs at the triggering threshold value of the input signal edge. With the **Edge triggering** selected, the trigger happens on the rise or fall edge of the input signal, shown as the following figure.

The **Edge triggering** menu is described in the following table.

Function menu	Settings	Description
Slope	Rising	Triggering on the rise edge of the signal.
	Falling	Triggering on the fall edge of the signal.
Source	CH1	CH1 is used as the trigger source.
	CH2	CH2 is used as the trigger source.
Mode	Auto	Acquisition of waveforms is possible even if there is no triggering condition detected.
	Normal	Acquisition of waveforms can only be done when the triggering condition is satisfied.
	Single	The sampling is performed on a waveform when one trigger is

		detected, then stop sampling. .
Coupling	AC	With this mode selected, the DC component is prevented from passing-though.
	DC	All components are allowed.
	HF Ric	The HF part of the signal is prohibited and only the LF component is allowed.
	LF Ric	The LF part of the signal is prohibited and only the HF component is allowed.

7.5.2 Video Triggering

With **Video triggering** selected, the oscilloscope performs the **NTSC, PAL** or **SECAM** standard video signals field or line trigger.

Now, you can see a screen that looks like the following figure 39, figure 40.

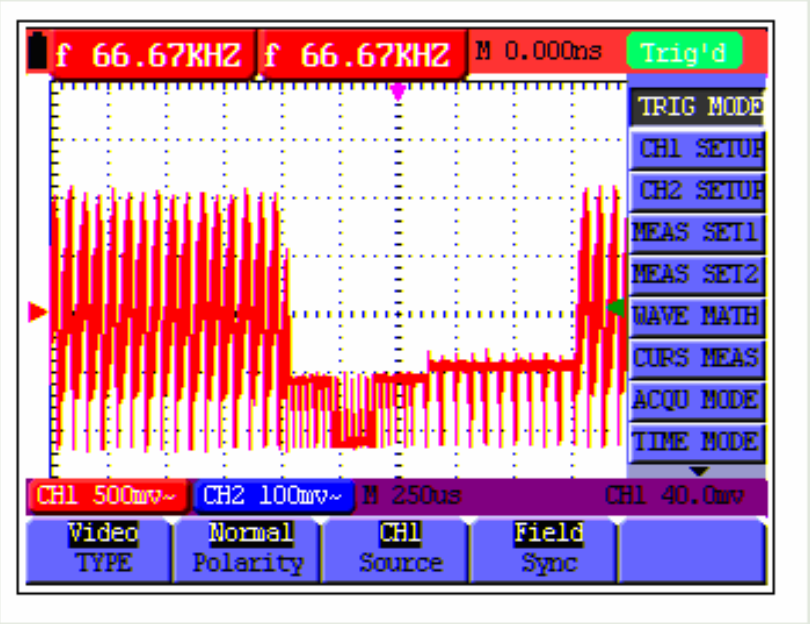


figure 39: Video Field Trigger

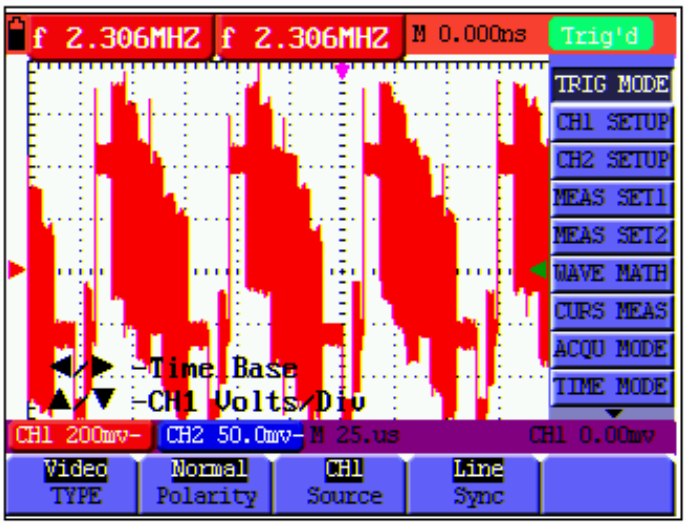


figure 40: Video Line trigger

The Video triggering menu is described in the following table.

Function menu	**Settings**	**Description**
Polarity	Normal Inverted	Applicable to the video signal in which the black level is of low level. Applicable to the video signal of which the black level is of high level.
Source	CH1 CH2	Select CH1 as the trigger source. Select CH2 as the trigger source..
Sync	Line Field	Make a video line trigger synchronization setting. Make a video field trigger synchronization setting..

Term interpretation

Trigger modes: There are three kinds of trigger modes available for this oscilloscope, they are auto, normal and single shot.

Automatic trigger mode: The oscilloscope can acquire the waveform without any triggering condition detected in this mode, in which it will be triggered compulsively when waiting for a specified period of time without any triggering condition ignited When an invalid trigger is enforced，the oscilloscope can not keep the waveform in phase.

Normal trigger mode: In this mode, the oscilloscope cannot acquire the waveform till it is triggered. When there is not any trigger, the oscilloscope will display the origin waveform without new waveforms captured.

Single shot mode: In this mode, the oscilloscope will detect a trigger and capture a waveform at each time when the customer presses the RUN/STOP key.

7.6 Acquiring Mode Setting

The **Acquiring Mode** menu is described in the list shown as below.

Function menu	Settings	Description
Sample		Normal sampling mode.
Peak Detect		Used to detect the jamming glitch and reduce the possible blurring.
Average		Used to reduce the random and unrelated noises. Several average factors are available for being selected.
Averages	4, 16, 64 or 128	Select the average factor.

7.7 Display Setting

The **Display Setting** menu is described in the following table.

Function menu	Settings	Description
Type	Vectors	The vector is filled up spaces between neighboring sampling points in the display.
	Dots	Only sampling points are displayed.
Persist	OFF 1s 2s 5s Infinite	Setting persistence time for each sampling point.
Format	YT	Display the relative relationship between vertical voltage and horizontal time.
	XY	Display CH1 on the horizontal axis and CH2 on the vertical axis.
Carry	Bitmap	The data transmitted in communication are bitmaps.
	Vectors	The data transmitted in communication are vectors.

7.7.1 Display Style

The display style includes **Vector** and **Dot** displays, shown as the following figure 41, figure 42.

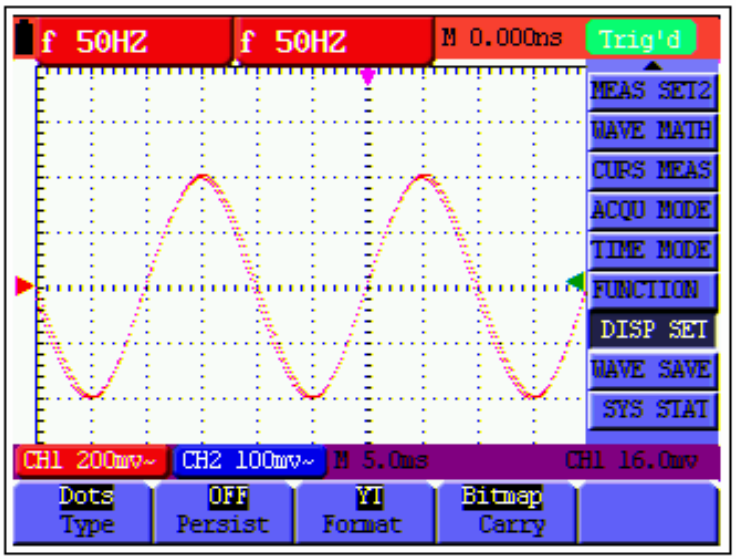


figure 41: Dot Style

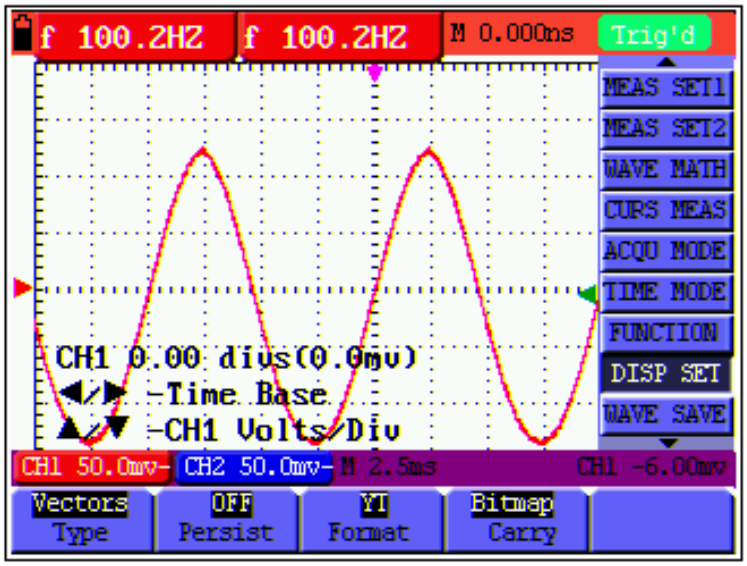


figure 42: Vector Style

7.7.2 Persistence

With **Persistence** function selected, the displayed saved original data gradually decay in color and the new data are bright in color; with infinite persistence mode selected, the recorded points will be kept on the screen till the controlled value is changed.

7.7.3 XY Mode

This mode is only applicable to CH1 and CH2. With the XY mode selected, CH1 is displayed on the horizontal axis and CH2 is on the vertical axis; when the oscilloscope is under the sampling mode in which no trigger is found, the data appear in light spots.

Operations for various control keys are shown as below:

- The **CH1 VOL** and **CH1 ZERO** for CH1 are used to set the horizontal scale and position.
- The **CH2 VOL** and **CH2 ZERO** for CH2 are used to set the vertical scale and position continuously.

The following functions do not work in the XY display mode:

- Reference or digital value waveform
- Cursor
- Time base control
- Trigger control

7.8 Waveform Saving Setups

The oscilloscope can save 4 waveforms, which can be displayed on the screen with the present waveform. The recalled waveform saved in the memory cannot be adjusted,

The **waveform saving /recalling menu** is described in the following list.

Function menu	**Setups**	**Description**
Source	CH1 CH2 MATH	Select the displayed waveform which you want to save.
WAVE	A, B, C and D	Select the address for saving or recalling a waveform.
Save		Store the waveform of a selected signal source into the selected address.
Show	ON OFF	Close or start displaying the waveforms stored in address A, B, C or D.

To save a waveform on CH1 in address A, do the following:

1. Press the **MENU** key and the function menu appears at the right of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to select the Waveform Saving. Four items selectable are displayed at the bottom of the screen.
3. Press the **F1** key to select the signal source CH1.

4. Press the **F2** key to select the address A.

5. Press the F3 key to save the waveform on CHI1 in address A.

To display the saved waveform on the screen, do the following:

6. Press the **F4** key to select Start for the address A. The waveform saved in address A will be displayed on the screen in green color.

The display color is green, and the zero point of waveform k, voltage and time is purple

Now, you can see a screen that looks like the following figure 43.

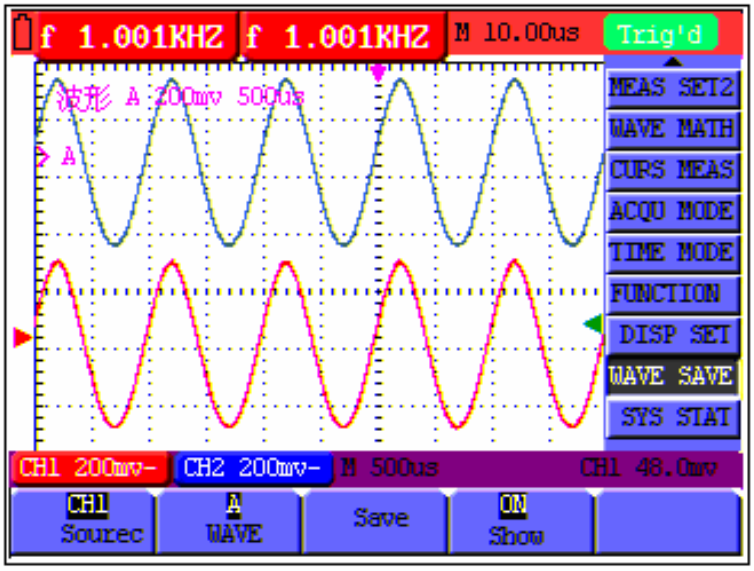


figure 43: Waveform Saving

7.9 Function Setting Menu

The **function setting** menu is described in the following list.

Function menu	Setting	Description
Recall Factory		Resume the instrument to its factory settings.
Auto Cailibration		Perform the Auto-calibration procedure.
Language	Chinese English	Select the display language of the operation system.

Self-correcting:

The self-correcting program can improve the accuracy of the oscilloscope under the ambient temperature to the maximum. If the ambient temperature variation is equal to or larger than 5 Celsius degrees, the self-correcting program should be performed to gain the maximum accuracy.

Before the self-correcting program is performed, the probe or lead should be disconnected with the

input connector, then, select the **F2** key **Self-correcting** item. After confirming that everything is ready, press the **F2** key "**Self-correcting**" key and enter into the self-correcting program.

7.10 Making Automatic Measurements

The oscilloscope can perform 5 types automatic measurements such as frequency, cycle, average value, peak-to-peak value and root mean square value. And gives two kinds of measurement results simultaneously on the screen.

The function menu for automatic measurements is described in the following list.

Function menu	Settings	Description
Freq	CH1	Measure the frequency of CH1
	CH2	Measure the frequency of CH2
Period	CH1	Measure the Period of CH1.
	CH2	Measure the Period of CH2
Mean	CH1	Measure the average value of CHI.
	CH2	Measure the average value of CH2.
Peak-Peak	CH1	Measure the peak-to-peak value of CH1.
	CH2	Measure the peak-to-peak value of CH2.
Cyc RMS	CH1	Measure root mean square (RMS) value of CH1.
	CH2	Measure root mean square (RMS) value of CH2.

To measure the frequency of CH1 with **Measurement 1** and the frequency of CH2 with **Measurement 2**, do the following:

1. Press the **MENU** key and the function menu is shown at the right of the screen.
2. Press the **MENU ▲** or **MENU ▼** key to select **Measurement 1**. Five options appear at the bottom of the screen.
3. Press the **F1** key to select the frequency measurement as **CH1.** The measurement window 1 on the screen turns into one red in color and shows the frequency of CH1.
4. Press the **MENU ▲** or **MENU ▼** key to select **Measurement 2**. Five options appear at the bottom of the screen.
5. Press the **F4** key to jump to the peak-to-peak measurement as **CH2**. The measurement window on the screen turns into one blue in color and shows the peak-to-peak value of CH2.

Now, you can see a screen that looks like the following figure 44.

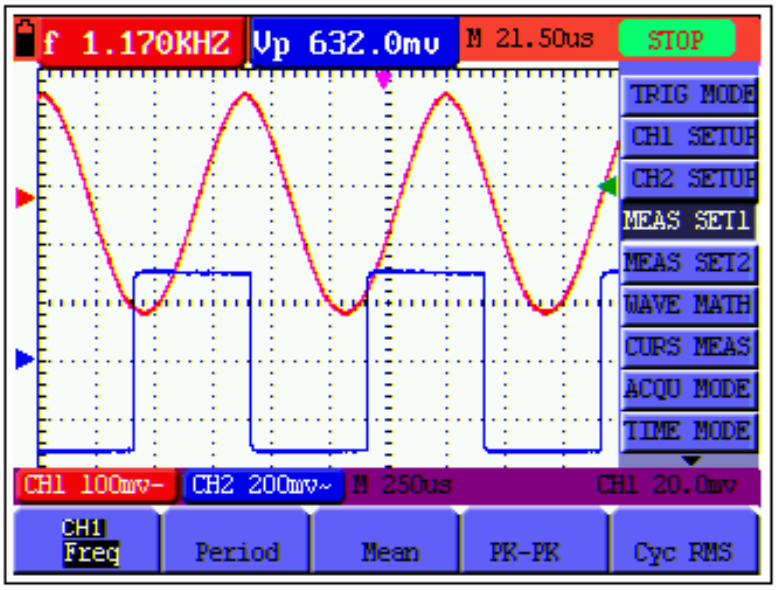


figure 44: Automatic Measurements

7.11 Setting the Cursor Measurements

This oscilloscope allows you to make manual cursor measurements on time and voltage. The signal sources include Channel 1(CH1), Channel 2 (CH2).

The cursor measurement menus are listed and described in the following table.

Function menus	Settings	Description
Type	OFF Voltage Time	Close the cursor measurement. Display the voltage measurement cursor and menu. Display the time measurement cursor and menu.
Source	CH1, CH2	Select the waveform channel on which the cursor measurement will be performed.

To make a voltage measurement on CH1, doing the following:

1. Press the **MENU** key and the function menus are displayed at the right of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to select **Cursor Measurement**. Two options are shown at the bottom of the screen.
3. Press F1 key to select the measurement type Voltage. Two purple crossing dashed lines V1 and V2 are shown on the screen.
4. Press the **F2** key to select the measured channel **CH1**.
5. Press and hold the **OSC OPTION** key till the **▲/▼ CURSOR V1** is visible on the screen. At this time, adjust **OSC** ▲ or **OSC** ▼ and you can see that the dashed line **V1** is moving

up and down while the measured voltage value of **V1** relative to the zero position of CH1 appears on the screen.

6. Press and hold the **OSC OPTION** key till ▲/▼ CURSOR **V2** appears on the screen. Now, adjust the **OSC** ▲ or **OSC** ▼ and you can observe the dashed line **V2** moving ▲ and ▼ while the measured voltage value of **V2** relative to the zero position of CH1 is displayed on the screen. Also, the absolute values of **V1** and **V2** can be shown on the screen.

Now, you can see a screen that looks like the following figure 45.

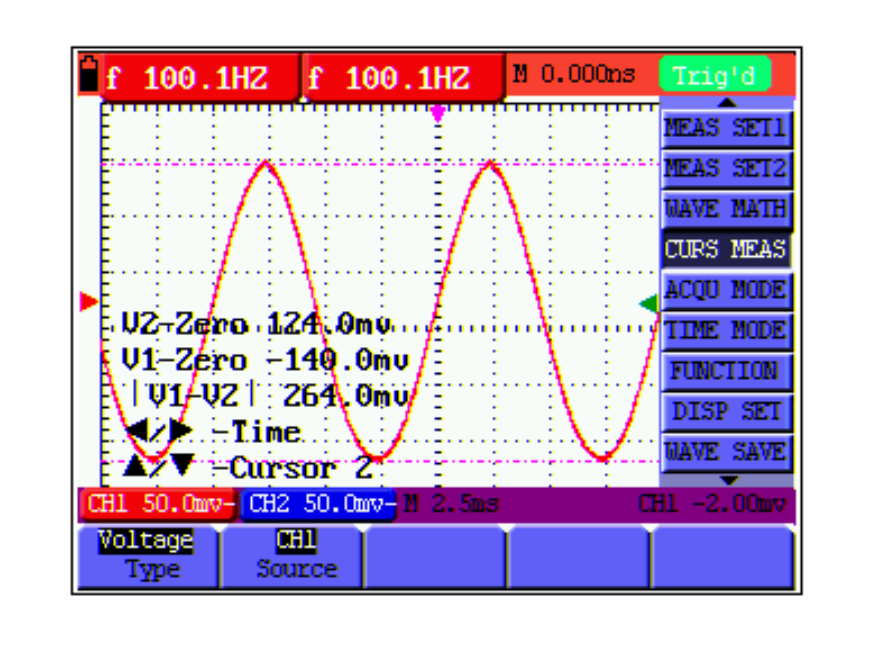


figure 45: Use the Cursor for a Voltage Measurement

To use the cursor for a time measurement on CH1, do the following:

1. Press the **MENU** key and the function menus are displayed at the right of the screen.

2. Press the **MENU** ▲ or **MENU** ▼ key to select **Cursor measurement** key. Two key labels selectable are shown at the bottom of the screen.

3. Press the **F1** key to the measurement type **Time.** Two vertical dashed lines T1 and T2 appear on the screen.

4. Press the **F2** key and jump to the measured channel **CH1**.

5. Press and hold the **OSC OPTION** key till the ▲/▼ **CURSOR T1** appears on the screen. Then, adjust the **OSC** ▲ or **OSC** ▼ and you can observe the dashed line moving left and right. At the same time, the time value of **T1** relative to the **screen middle point position** will be displayed on the screen.

6. Keep pressing on the **OSC OPTION** key till the ▲/▼ **CURSOR T2** is displayed on the screen. Then, adjust the **OSC** ▲ or **OSC** ▼ and you can find that the dashed line **T2** is moving right and left while the time value of **T1** relative to the **screen middle point**

position appears on the screen. You can also observe the absolute time values and frequencies of **T1** and **T2.**

Now, you can see a screen that looks like the following figure 46.

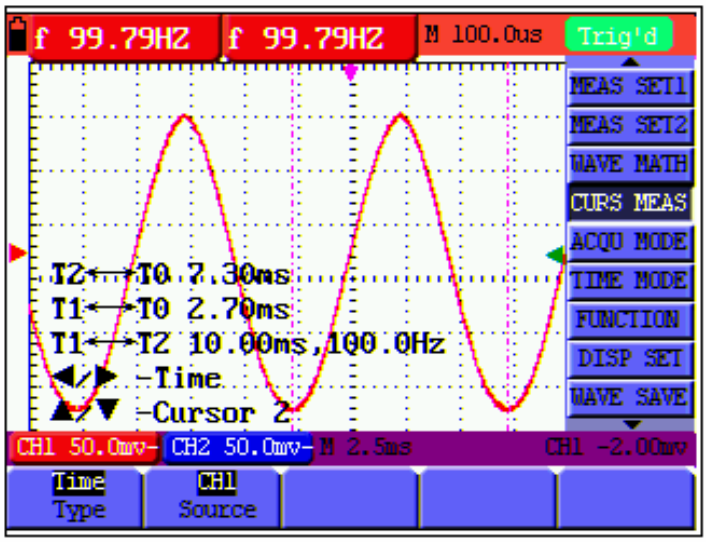


figure 46: Use the Cursor for a Time Measurement

7.12 System State Menu

The system state menu is used to display information about the present horizontal system, vertical system, trigger system and others. The operation steps are shown as below.

1. Press the **MENU** key and the function menu is displayed at the right of the screen.
2. Press the **MENU** ▲ or **MENU** ▼ key to select the **System State.** Four options appear at the bottom of the screen.
3. Sequentially press key **F1** through **F4** key and the corresponding state information will be shown on the screen.

The screen that looks like the following figure 47 will be displayed.

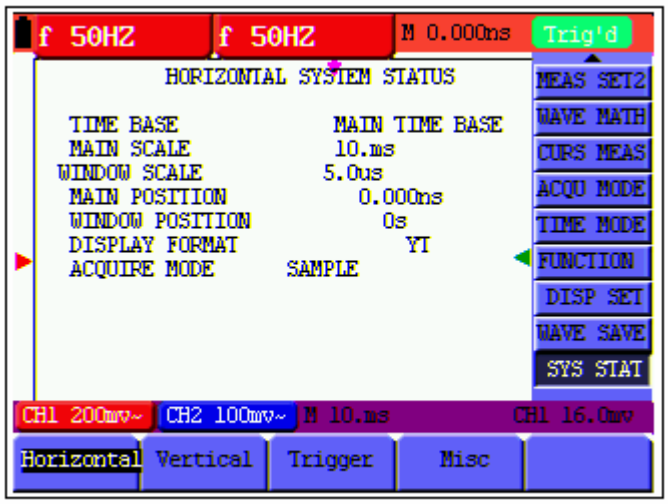


figure 47: System State

7.13 Setting of Time Base Mode

The time base mode menu is explained as the following table.

Function menu	Setting	Explanation
Main TimeBase		Horizontal main time base is used to wave display
Zone Window		Use two cursors to define a window area
Window		Expand the defined window to full-screen display

For the operation of window extension, please execute the following steps:

1. Press **MENU** key, display the function menu on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select time base mode, display three options at the bottom.
3. Press F2 key to select window setting.
4. Press **OSC OPTION** key, pop up **TIME BASE**, at this time, then press **OSC** ◄ and **OSC** ► key to adjust the time base window area defined by two cursors, the window size will vary.
5. Press **OSC OPTION** key and call **TIME**, at this time, press **OSC** ◄ and **OSC** ► to adjust the window position defined by two cursors, the window position is the time difference of the window center to main time base's horizontal pointer.
6. Press **F3** key, select window extension, the defined window extends into the full-screen display.

The screen that looks like the following figure 48, 49 will be displayed.

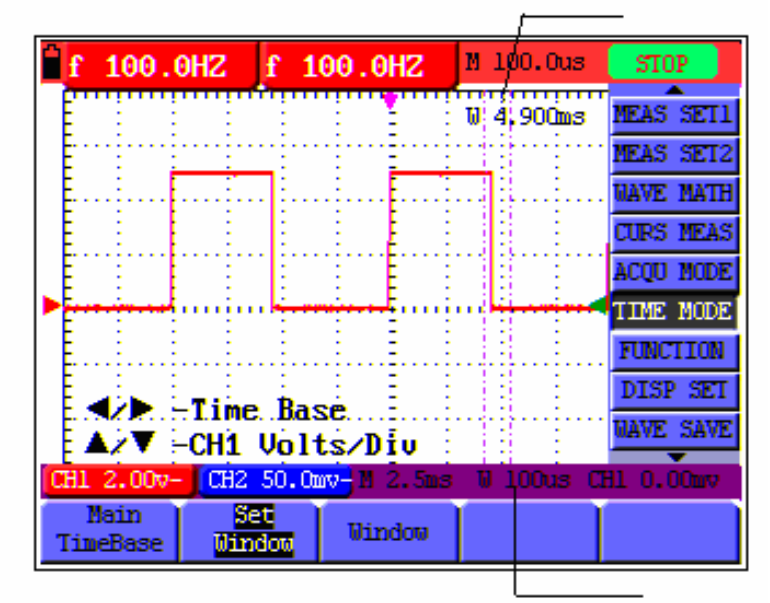


figure 48: Window Setting

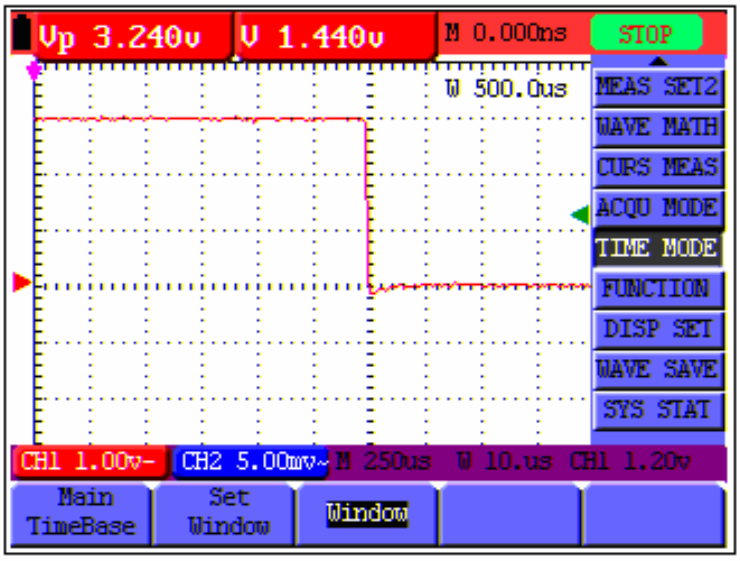


figure 49: Window Extension

7.14 Data Transmission

For the operation of data transmission, please execute the following steps:

1. Press **MENU** key, display the function menu on the right side of the screen.
2. Press **MENU** ▲ or **MENU** ▼ key to select display setting mode, display four options at the bottom.
3. Press **F4** key, and select the **Bitmap** or **Vectors** for data transmission.
4. Use a data line to connect the oscilloscope and the PC .

5. Open the OWON software that had been installed completely.
6. Setting the parameter under the use's manual, and then starts data transmission.

8.FAQ

1. The oscilloscope does not power up

It may be caused by the dead battery. At this time, the oscilloscope will not start even if it is powered by the battery charger. Firstly, charge the battery and supply the oscilloscope with power through the battery charger. However, don't switch on the oscilloscope till waiting for 15 minutes. If the oscilloscope still cannot start, please contact OWON for service.

2. The oscilloscope stops working only after operating for several seconds

Probably the battery is dead; Check the battery symbol at the upper right of the screen. The symbol indicates that the battery has been run out of power and must be charged.

3. The measurement type displays ERR when you switch to the Multimeter mode.

Probably you do not select the measuring mode. In this case, push down any key of the three keys V, A or R. Thus, the relative measuring mode will be shown on the screen. If the ERR is still displayed, restart the oscilloscope.

4. The measured voltage amplitude value is 10 times larger or smaller than the real value under the oscilloscope mode.

Check whether the channel attenuation level matches the actual probe attenuation ratio.

5. The waveform is displayed on the screen but is not stable under the oscilloscope mode.

- Check whether the signal item in the trigger mode menu matches the actually used signal channel.
- Check on the trigger mode: The edge trigger mode is applicable to the universal single and the video trigger mode applicable to the video signal. Only when the proper trigger mode is applied, can the waveform be in stable.

- Try to change the trigger coupling into the HF rejection and LF rejection to filter the HF or LF noise trigger by the interference.

6. There is no display on the screen when you push down RUN/STOP key under the oscilloscope mode.

Check whether the trigger mode in the trigger mode menu is in normal or single shot and whether the trigger level is out of the waveform range.

In such condition, adjust and make the trigger level in the middle or select the non-auto trigger mode. Additionally, press the AUTO SET key and complete the above setting

7. When select the average sampling in the sampling mode or select a longer display time in the display mode under the oscilloscope, the display speed is slow.

It is normal in the above case.

9.Appendix

9.1 Appendix a Specifications

9.1.1 Oscilloscope

Only if another instructions are provided, are all technical specifications applicable to the probe with the 10X attenuation switch setting and the HDS series digital type oscilloscope. In order to be up to these specifications, the oscilloscope should meet the following requirement.

- The instrument should operate continuously for more than 30 minutes under the specified operating temperature.
- If the operating temperature range of variation is up to or larger than 5 Celsius degrees, the system function menu must be opened to make the system perform a "self- calibration" procedure.

Except those specifications marked with the word **Typical**, all specifications can be up to.

Sampling

Sampling modes	Normal sampling Peak detection Average value
Sampling rate	100 MSa/s

Input

Input coupling	DC, AC,Groud
Input impedance	1MΩ ±2% connected in parallel with 20pF±5pF
Probe attenuation coefficient	1X, 10X, 100X, 1000X
Max. Input voltage	400V (peak)
Channel delay time（typical）	150ps

Horizontal

Sampling rate range	10S/s～100MS/s
Waveform interpolation	（sin x）/x
Record length	6K points on each channel
Scanning speed range（S/div）	5ns/div～5s/div, stepping in the "1-2.5-5" mode.
Sampling rate and relay time accuracy	±100ppm(any time interval which is equal to or larger than 1ms)
Time interval (△T)measurement accuracy（full bandwidth）	Single: ± (1 sampling interval time+100ppm × reading+0.6ns)

	>average 16 : ±(1 sampling interval time +100ppm× reading+0.4ns)

Vertical

Analog digital converter（A/D）	With the resolution of 8 bits, make sampling on both channels synchronously.
Sensitivity range （V/div）	5mV/div～5V/div（at the input BNC）
Displacement range	±50V(500mV～5V),±2V(5mV～200mV)
Analog bandwidth	20M
Single bandwidth	Full bandwidth
Low frequency response （ AD coupling, -3dB）	≥5Hz（at the BNC ）
Rise time（typical one at the BNC）	≤17.5ns
DC gain accuracy	±5%
DC measurement accuracy（average value sampling mode）	The voltage difference (△V) between any two points on the waveform after averaging the captured waveforms more than16: ±(5% reading + 0.05 divisions).

Trigger

Trigger sensitivity （Edge triggering）	DC coupling	CH1 and CH2: 1div(DC～full bandwidth)
	AC coupling	Same as the DC coupling when it is equal to or larger than 50Hz.
Triggering lever range		±6 divisions from the screen center
Triggering level accuracy (typical) which is applicable to the signal with rise and fall time equal to or longer than 20ns	±0.3 divisions	
Trigger displacement	655 divisions for pre-triggering and 4 divisions for post-triggering	
Make a 50% level setting (Typical).	Operation with the input signal frequency equal to or larger than 50Hz.	
Trigger sensitivity (Video triggering and typical mode)	2 divisions of peak-to-peak value	
Signal system and line/field frequency (Video triggering mode)	Support the NTSC, PAL and SECAM broadcasting systems of any field or line frequency.	

Measurement

Cursor measurement	Voltage difference (△V) and time difference (△T) between cursors
Auto measurement	Peak-to-peak value, average value, root mean square value, frequency and period.

Probe

	1X position	10X position
Bandwidth	Up to 6 MHz (DC)	Up to full bandwidth (DC)
Attenuation rate	1: 1	10: 1
Compensation range	15pf～35pf	
Input resistance	1MΩ ±2%	10MΩ ±2%
Input impendence	85pf～115pf	14.5pf～17.5pf
Input voltage	150 V DC	300 V DC

9.1.2 Meter

Voltage (VDC)

Input Impedance: 10MΩ.

Max. Input Voltage: 1000V (DC or AC peak-to-peak value)

Range	**Accuracy**	**Resolution**
400.0mv	±1%±1 digit	100uV
4.000V		1mV
40.00V		10mV
400.0V		100mV

Voltage (VAC)

Input Impedance: 10MΩ.

Max. Input Voltage: 750V(AC, virtual value)

Frequency range: from 40Hz to 400Hz.

Display: Virtual value of the sine wave

Range	**Accuracy**	**Resolution**
4.000V	±1%±3 digits	1mV
40.00V		10mV
400.0V		100mV

Direct Current (DC)

Range	Accuracy	Resolution
40.00mA	±1%±1 digit	10uA
400.0mA	±1.5%±1 digit	100uA

20A	±3%±3字	10mA

Alternating Current (AC)

Range	Accuracy	Resolution
40.00mA	±1.5%±3 digit	10uA
400.0mA	±2%±1 digit	100uA
20A	±5%±3字	10mA

Resistance

Range	Accuracy	Resolution
400.0 Ω	±1%±3 digits	0.1 Ω
4.000K Ω	±1%±1 digit	1 Ω
40.00K Ω		10 Ω
400.0K Ω		100 Ω
4.000M Ω		1K Ω
40.00M Ω	±1.5%±3 digit	10K Ω

Capacitance

Range	Accuracy	Resolution
51.20nF	±3%±3 digits	10pF
512.0nF		100pF
5.120uF		1nF
51.20uF		10nF
100uF		100nF

Diode

Voltage reading: 0 V ～1.5 V.

On-off Test

You can a beep sound when the on-resistance is less than 50 Ω.

9.1.3 General Specifications

Basic parameter

Mechanical dimension	18 cm×11.5cm×4cm
Weight	645 g
Power consumption	＜ 6 W
Display type	3.8" color liquid crystal display
Display resolution	320 (horizontal) ×240 (vertical) pixels
Display color	4096 colors

Power Adapter

Power supply	100-240 V AC 50/60Hz
Power output	8.5 VDC
Current output	1500 mA

Battery:7.4V built-in Li-ion Battery

Working environment

Temperature

Operation

Used battery 0 to 50 °C(32 to 122 °F)

Power adapter 0 to 40 °C(32 to 104 °F)

Storage. -20 to +60 °C(-4 to +140 °F)

Temperature

Operation:

0 to 10 °C(32 to 50 °F) no condensation

10 to 30 °C(50 to 86 °F) 95 %

30 to 40 °C(86 to 104 °F) 75 %

40 to 50 °C(104 to 122 °F) 45 %

storage

-20 to +60 °C(-4 to +140 °F). no condensation

9.2 Appendix B: Maintenance and Cleaning

9.2.1 Common Maintenance

Do not store or place the instrument in locations where the liquid crystal display (LCD) may be directly exposed to the sunshine for a long time.

Be careful: Do not make spraying agent, liquid and solvent touch with probes to avoid the instrument or probe being damaged.

Cleaning

Inspect the instrument and the probe frequently in accordance with operating conditions. Clean the outer surface of the instrument according to the following steps:

1. Wipe off the floating dust outside of the instrument and the probe by using soft cloth. When cleaning the LCD, do not scuff the transparent LCD protective screen.
2. Wipe the instrument in power off status by soft cloth that is moist but not dripping. It is

allowed to be cleaned by soft detergent or fresh water. Do not use any abrasive chemical detergent to avoid the instrument or the probe being damaged.

Warning: Before repowering and reuse, please confirm that the instrument has been dried out so as to avoid electrical short circuit and personal injury caused by moisture.

9.2.2 Storage of Oscilloscope

If the test tool is to be stored for a long time, it is required to charge the lithium battery before storage.

Charging the oscilloscope

The lithium battery is possibly not charged when delivery. To make the battery with enough electric quantity, it must be charged for 4 hours (the test tool must be turned off during charging). The battery can supply power for 4 hours after being charged completely.

When supplying power by using the battery, a battery indicator is displayed on the top of the screen to show the consumption condition of electric quantity. The symbols that are possibly appear include , , and , where shows that the battery can only be used for about 5 minutes. To charge the battery and power the instrument, connect the oscilloscope using a power adapter according to Figure 1 to charge the battery. The charging speed can be increased by turning off the test tool.

Notice

To avoid superheat of battery during charging, the environment temperature is not allowed to exceed the permissible value given in technical specification.

Note:

No hazard will occur even connecting the charger for a long time, e.g. during a whole weekend. The instrument can automatically switch to slowly charging status.

9.2.3 Replacing the Lithium Battery Unit

It is usually not required to replace the battery unit. But when it is required to replace it, only qualified personnel can carry out this operation, and only use the same specification lithium battery.